KNOWLEDGE

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P PHARMACY (part two)

A tube of pastilles – medicaments incorporated in a gelatine base

EVERYONE knows that aspirin will cure a headache, but few people are aware that it is made from coal. Cough mixture, likewise, is expected to cure a cough, but only one person in a thousand knows that the relief it gives is often due to the presence of *codeine*, an alkaloid obtained from the seed heads of poppies. Modern medicines are derived from almost unbelievably diverse sources, for pharmaceutical chemists have searched the whole of nature and industry for the raw materials from which to make their products.

The sources of drugs

For thousands of years most drugs were obtained from plants. Herbs with medicinal properties were collected, dried, and then soaked in water. The drug leached (seeped) out of the plant into the water, which was then used medicinally. Many of these old remedies have now been replaced with drugs made in the laboratory, but there are still some which have an important part to play in treatment. Digitalis, used in heart disease, is made from foxglove leaves; opium, used to relieve pain, is made from poppy heads; and quinine, for the treatment of malaria, comes from the bark of the cinchona tree.

In the 16th century the great physician Paracelsus advocated the adoption of many simple inorganic chemicals, and some of these are still used. Sodium bicarbonate relieves indigestion, Epsom salts (magnesium sulphate) is an effective purge, and common salt (sodium chloride) is used in large amounts in fluids given by transfusion.

In contrast to these inorganic chemicals there are many complex organic chemical drugs made in the laboratory. These are almost all products of the 20th century. Some are by-products of industrial processes, while others are specially made. The sulphonamides, used to treat bacterial infections, are by far the most famous of this kind of drug. There are, however, very many other drugs of this type, and they are used for purposes as different as relieving pain, reducing high blood pressure, and ameliorating the symptoms of hay fever.

Finally, there are drugs which are obtained from very small living organisms, such as moulds, bacteria, and viruses. These *micro-organisms* can be made to grow in the laboratory, and yield many useful drugs. Moulds produce antibiotics like penicillin and streptomycin, while bacteria and viruses are grown to make vaccines which protect people from such unpleasant illnesses as diphtheria, whooping-cough, tetanus, and poliomyelitis.

The presentation of drugs

Henbane (Hyoscyamus niger) – relaxes intestinal muscles

Pharmacists not only try to provide doctors with the best drugs; they also try to present these drugs to the patient in such a way that they work well and are convenient to take.

Drugs which are soluble in water are often presented as *mixtures*. Others, particularly if they are intended for children, are made up as *syrups* or *linctuses* which are sweet and pleasant to take. Inevitably, liquid medicines are a little inconvenient, and, moreover, they are often very bitter. Because of this certain drugs are made into *pills*, or little pellets surrounded by a sweet coat. Other drugs are presented as *capsules*, in which the drug is contained in a spherical or torpedo-shaped 'box' of gelatine, or *cachets*, in which the drug is wrapped between two tiny sheets of rice paper. In *tablets* the drug is compressed into small discs. Occasionally drugs are presented as *powders* or *granules*.

Drugs which would be destroyed by the digestive juices if taken by mouth are usually given by injection with a syringe. Manufacturers prepare such drugs in *ampoules*, each of which contains a single dose.

There are also *ointments* and *pastes*, which are used for skin diseases; drops for the nose, the eyes, and the ears; inhalations for the chest; poultices for septic fingers; lozenges for sore throats; and shampoos for dandruff.

Gentian (Gentiana lutea) – used in tonic

Dispensing a prescription

Fifty years ago prescriptions were written like recipes, and to dispense them the pharmacist took the ingredients from the bottles on his shelves and mixed them together. Today, when three-quarters of all prescriptions are for medicines ready-made by manufacturing chemists, the pharmacist often has only to measure out the right amount and, after this, merely to label the container.

Previous page: (top) the materials with which a dispensing chemist (pharmacist) prepares a medicine in accordance with a doctor's prescription (centre), and (bottom) pharmaceutical preparations ready-made by a manufacturing chemist.

EUROPE BETWEEN 1919 and 1939

WE saw on page 2742 the great changes wrought in Europe by the First World War. The defeated powers were drastically punished and made to pay enormous reparations (payments for war damage). Their boundaries were reduced, and out of the once mighty Austria-Hungary were carved a number of new states.

With the end of the war a thrill of hope ran through a battered Europe. The intervention of America had meant that a great new force for peace and democracy had entered the arena of world politics. Democracies had won and were everywhere in the ascendant – countries like Britain, France, Italy, and America. Many new nations established liberal constitutions – even Germany was under the government of the democratic 'Weimar' constitution. The League of Nations was formed to preside over and guard the 'new' Europe. It was said that the Great War had been a 'war to end all wars', and the world had been 'made safe for democracy'.

There are few more extraordinary sequences of events in history than those which led to the collapse of this democratic triumph and the rapid descent into the abyss of a new and even more terrible war.

Black-bordered areas show extent of German expansion by 1939

Rival ideologies

One of the main reasons for world tension in the inter-war years was the development of rival ideologies, or theories of government. In Russia the Bolshevik Revolution established *Communism*, while Lenin preached class war and the overthrow of capitalist regimes. Stalin, who seized control in about 1927, modified his attacks on capitalist countries. However, there remained a deep-rooted ideological rift between Communism and democracy, and in particular between Communism and Fascism and Nazism.

When Mussolini 'marched on Rome' in 1922 he was appointed Prime Minister. He soon established himself as a *Fascist* dictator, took the title *Duce* (leader) and pledged himself to creating a powerful, aggressive Italy.

In Germany Adolf Hitler came to power in 1933. He was the leader of the *Nazi*, or National Socialist, Party, and combined a Fascist philosophy with a racial policy of his own. His object was the elimination of 'inferior' races like the Jews and Slavs. He also denounced the Treaty of Versailles (see page 2742) and demanded enlarged frontiers for Germany. This expansion was called a policy of *Lebensraum*, or 'living space', and was intended to be towards the east, mainly at the expense of Russia. These views were all expressed in Hitler's book, *Mein Kampf* (1924).

◀ *Lenin* (1870–1924)

Stalin (1879–1953) ▼

The tragic years: 1933–1939

Hitler's advent to power brought a new, tenser atmosphere in European politics. He established himself in Germany by bloody methods. He eliminated the Communists from the *Reichstag* and passed an 'Enabling law', giving him complete power in Germany. In 1934 he took over the office of President, which he combined with that of Chancellor, and had hundreds of his own followers murdered on 30th June – the 'Night of the Long Knives'. This was to please the German High Command which distrusted a certain section of the Nazis on the grounds that it wished to supersede the German army with a Nazi Party army. From then until after the outbreak of a new world war Hitler and the German army worked in close harmony – a fateful harmony for Europe.

In 1935 Hitler announced his policy of rearmament and conscription. This was in direct defiance of the Versailles treaty, but no direct action was taken. France's reaction was to form a defensive alliance with the Soviet Union, which was immediately denounced by Hitler as a threat to Germany. Using this as a pretext, he sent an army of 36,000 men into the Rhineland in March 1936. The Rhineland had been demilitarised by the Versailles treaty, so this action was a direct challenge to the European powers. French opinion was roused, but the government failed to act. It is possible that if Britain had agreed

The humiliation of Germany after Versailles was deepened by France's unreasonable demands for reparations and insistence on a totally inadequate German army. In 1923, when German economic difficulties prevented reparation payments, France occupied the rich Ruhr district. British opinion was hostile to this example of French aggressiveness. Nevertheless, in the latter part of the 1920s an atmosphere of optimism prevailed in Europe. Gradually Germany recovered some of her prosperity, largely due to American loans under the Dawes Plan of 1924. Germany's able Chancellor, Gustav Stresemann, inspired confidence and hopes that Europe's boundaries were satisfactorily settled. In 1925 a series of famous agreements were made at Locarno. These guaranteed the Franco-German frontiers in a document signed by Germany, France, Britain, Italy, and Belgium. In addition, France guaranteed the boundaries of Poland and Czechoslovakia.

The signing of the Kellogg-Briand Pact in 1928. Frank Kellogg was the American Secretary of State; Aristide Briand was the French President

It was significant that Britain refused to join these eastern guarantees. Greater perception on her part might have averted the later disaster of Munich, but the atmosphere of optimism prevailed. In 1928 the Kellogg-Briand Pact 'outlawed' war and was signed by all the major powers. This utterly meaningless pact was widely paraded as a symbol of international peace. But in 1929 a world-wide economic slump spread from America and dislocated the European economy. America's loans were withdrawn. In that year Stresemann died, and German politics were plunged into chaos. The Nazi Party members in the *Reichstag* increased from 12 to 107 in 1930. After a succession of ineffectual Chancellors, Hitler became Chancellor of Germany in 1933.

to fight, France would have done so too, but Britain could see little need to support a powerful France against a mere 36,000 Germans.

It was also in 1935 that Mussolini invaded Abyssinia. He was enthusiastically supported by his fellow dictator, Hitler, though the League of Nations formally condemned his action. The League's opinion made no difference. Already, in 1931, its prestige had suffered when it condemned Japan's invasion of Manchuria – the only result was that Japan left the League. Similarly, Mussolini defied the League, and it soon withdrew its 'sanctions' against Italy.

By 1936 the conflict between the democracies and the dictators was in full swing, and press campaigns launched a growing propaganda of hate. In that year the Spanish Civil War (see page 2604) broke out, and the League was powerless to prevent hordes of Italian and German planes and troops lending their support to the Fascist Party in Spain. This war provided welcome practice for the dictators' new weapons and, in particular, the German *Luftwaffe*.

Europe was rapidly crystallising into armed camps. In 1936 Germany and Japan had formed the anti-Comintern (anti-Communist) Pact, which was shortly joined by Italy. In 1937 Mussolini paid a triumphant visit to Germany, and the new 'axis' between Berlin and Rome was joyfully publicised. Hitler at once took characteristic advantage of his ally. Italy had always been the main opponent of any German link with Austria, but now Hitler could see no reason for holding back. The ground was well prepared, and campaigns against the Austrian government and its Chancellor Schuschnigg began. Nazi groups in Austria demonstrated in favour of joining Hitler's Third Reich. In March 1938 German troops marched into Austria, and the country was annexed. The shock to the rest of Europe was great, but worse was quickly to follow. In May 1938 a crisis arose over Germany's relations with Czechoslovakia. Within Czech territory there were some 3 million Germans, living in the Sudetenland. Hitler demanded that these Germans be reunited with their brother Germans in the Reich. 'Incidents' between Czechs and Germans were manufactured, and the German press howled about 'atrocities' committed against the Germans by the Czechs. The German propaganda machine, under its chief,

Adolf Hitler (left) became German dictator in 1933. He introduced a policy of rearmament which transformed Germany into the strongest military power in the world. He also introduced compulsory call-up (conscription)

Josef Goebbels, poured out a constant stream of invective against the Czechs. German troops mysteriously approached the Czech border, and Czechoslovakia responded by partial mobilisation. A war seemed imminent. France and Britain were by now extremely alarmed by Hitler's aggression, and both Deladier and Chamberlain urged Hitler not to invade. France had a treaty obligation to maintain Czechoslovakia's frontiers, though Britain had not. Finally, with Hitler's fury against Czechoslovakia mounting, Chamberlain proposed a conference between the great powers. It met at Munich, and Britain and France submitted to Hitler's demands. On the night of 29th–30th September it was agreed that the Sudetenland should be transferred to Germany. Chamberlain returned to London saying that he had achieved 'peace in our time'. He had a rude awakening. The following March German troops marched into Prague and seized Moravia and Bohemia. Czechoslovakia was snuffed out.

This was decisive. Up till now Hitler's

policies of 'risks' had paid off, but now a new resolution was apparent in Western diplomacy. Chamberlain called it a 'new era' and announced great increases in armament expenditure. Danger was now acute. Hitler's press began to rave against Poland and denounce the 'Polish corridor' (see page 2742). On 6th April an Anglo-Polish alliance was concluded. The following day Italy invaded Albania – one further example of the insatiable appetites of the axis powers. On 15th April the United States President, Roosevelt, asked the dictators to guarantee that they would not attack some 30 countries he named. The reply was evasive. On 27th April Britain introduced general conscription for the first time ever in peace. The following day Hitler intoxicated a vast Nazi rally with blistering attacks on the Western powers and on Poland. The climax of his speech was a dramatic repudiation of the Polish-German non-aggression pact concluded in 1934. This was a clear prelude to invasion.

A decisive moment – Hitler enters Vienna (14th March 1938)

One country that could be expected to be terrified by an invasion of Poland was Russia. As the customary press campaigns against Polish 'atrocities' on Germans intensified, so negotiations were set on foot for an alliance between France, Britain, and Russia. Russia, indeed, had everything to lose. The annexation of Poland would enormously help the Germans both materially and strategically. Moreover, Hitler had always denounced the Russians and abused the 'inferior Slavs'. Yet the negotiations were mishandled. Russia suspected that she was being duped into embroiling herself in a war with Germany, in which France and Britain would sit back and watch the two nations bleed each other to death.

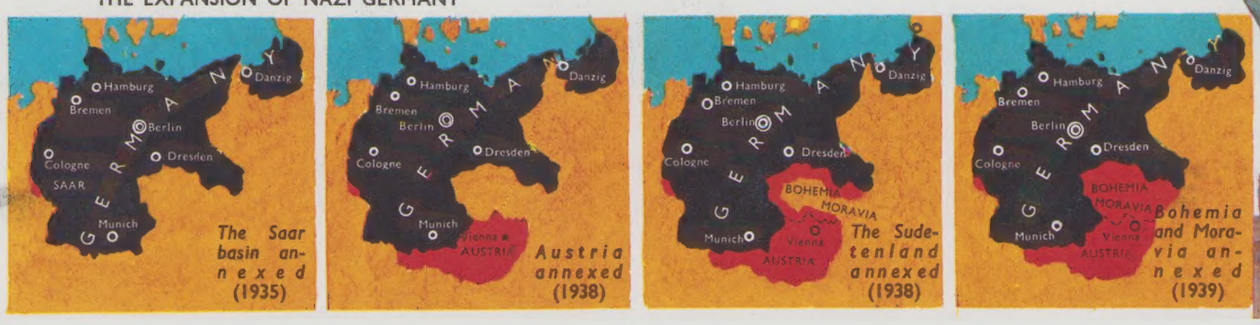
Suddenly, on 21st August, came one of the biggest diplomatic shocks in history. The German Foreign Minister, von Ribbentrop, gleefully announced the imminence of a Russo-German non-aggression treaty! The effect was profound. Chamberlain called it a 'bombshell'. Germany had apparently forgotten her hatred of the Communists, and renounced her often-repeated demands for German expansion in Russian territory. The sinister reason behind this treaty was plain: Germany was now free to invade Poland without fear of being 'stabbed in the back' from the east by Russia.

Hitler hoped that the Western powers would recognise their defeat and back down, but on 25th August Chamberlain announced a new Anglo-Polish alliance.

The German war machine was now in motion. The High Command was moving tanks and troops towards the Polish border. Hitler paid lip-service to last-minute appeals for peace from Chamberlain, Roosevelt, and Pope Pius XII. But it was too late. High Command plans were complete, and at midnight on 1st September German tanks rumbled into Poland. Panzer divisions poured over the frontier and the *Luftwaffe* rained bombs on helpless Polish cities. The final chapter had begun. On 3rd September ultimatums from Britain and France received no reply. By that evening both countries had announced a state of war with Germany.

Hitler the demagogue

THE EXPANSION OF NAZI GERMANY



BRAZIL: physical

THE most striking fact about Brazil is its size; it is only slightly smaller in extent than the whole of continental Europe. Yet this country, which is the fifth largest in the world, has a population of 70·5 million (1960), not very much larger than that of the United Kingdom (52 million). Most of the people live on the south-east coast around São Paulo and Rio de Janeiro.

Brazil is a country of dense tropical forests and vast grassland plateaux. The lowlands of the great Amazon river basin contrast with the uniform plainland of the Brazilian Highlands, a great savannah grassland almost untouched by the hand of man.

THE PLAIN OF THE AMAZON

The basin of the Amazon (see page 1208) is the largest alluvial plain in the world; flat land stretches eastward into Brazil from the base of the Andes in Bolivia, Peru, Ecuador, and Colombia. The Amazon basin, unlike most river basins, becomes narrower towards the river mouth, and in the eastern part only a narrow ribbon of floodplain carries the river through the Highlands on its journey to the sea.

It is with the forest, more than with any other feature of this region, that man must contend. The whole plain is covered with dense evergreen tropical forest (*selva*) – evergreen because there is no frost or drought to dictate a seasonal rhythm of growth. Each different species of tree blossoms and produces its fruit in its own period. There are a great many species of trees, creepers, and undergrowth competing to reach upwards into the sunlight, for the rays of the sun rarely penetrate this dense tangle of growth. The forest frustrates the settler who tries to clear it; new growth springs up almost as soon as he has cut it back. But it is in the forest that the main riches of the region lie: tropical hardwoods, nut trees, and rubber trees (*hevea*). However, their inaccessibility has made it unprofitable to exploit them.

To penetrate the jungle at all the traveller must use the rivers, which are navigable to the limits of the plain. But even there he encounters further hazards in the profusion of dangerous snakes and insects which infest the region. The Amazon basin remains one of the great undiscovered areas of the globe.

THE OTHER PLAINS

In comparison with the vast Amazon basin the other plainlands of Brazil are insignificant, though they are large by any other standard. The basins of the Paraná and Paraguay rivers, with their famous pampas grasslands, extend across the political boundary with Paraguay. The land close to these rivers is swampy, but can be used for summer grazing. Most of the land is very fertile, and all types of crops and grass can be grown. The alluvial lowlands and coastal swamps from the Amazon mouth to Fortaleza contrast with the small pockets of lowland confined by the hills of the Brazilian Highlands in the south-east.

Curious-looking flat-topped chapadas rise above the general level of the Brazilian Highlands

MOUNTAINS

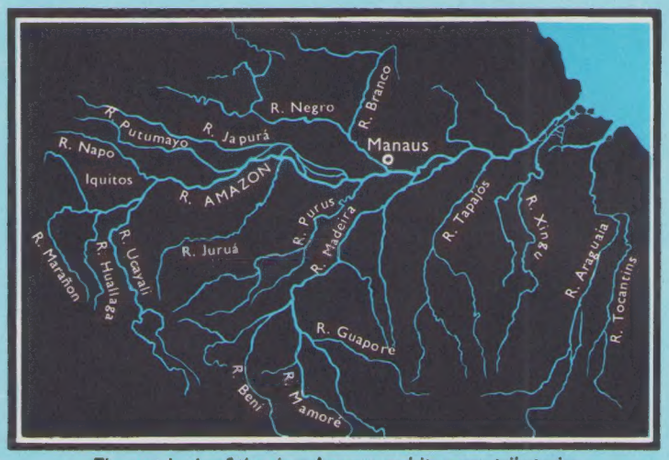
Very few peaks rise above the general surface level of the Brazilian Highlands. The highest mountain in Brazil is the Pico da Bandeira (9,462 feet), just north of Rio de Janeiro, while the highest peak of the Guiana Highlands (north of the Amazon) is 8,635 feet. The most important mountain chains (the Serra do Mar, Mantiqueira, and Espinhaco) barely exceed 9,000 feet. They lie parallel to the south-east coast of the country and, together with the Great Escarpment, a steep wall-like slope rising to 2,600 feet, which runs close to the coast between Salvador and Pôrto Alegre, have proved an obstacle to opening up the interior.

THE MATO GROSSO

The great Brazilian Highlands are separated from the coast and the lowlands by steep scarp slopes; the interior part of this ancient tableland is called the *Mato Grosso*. Although the name means 'thick forest', most of the *Mato Grosso* is, in fact, covered by savannah grassland. The rainfall is seasonal, falling mainly in the southern hemisphere summer (October to April). This limits the growth of forest on the plateau, though evergreen tropical forests flourish in the hot, moist valleys of the tributaries draining north to the Amazon. Most of the area is rolling tableland (usually between 2,000 and 5,000 feet high); in the higher parts horizontal sandstones often cap flat-topped hills, known locally as *chapadas*. In the south-east the mountains plunge spectacularly to the coast, particularly around the beautiful city of Rio de Janeiro (see page 1074).

THE RIVERS

If a traveller were to make a journey along the Amazon from Leticia, on the Peruvian border, to Belém, on the coast, he would cover a distance of 1,700 miles; but he would still have travelled only half the length of the great river. Not only is the Amazon great in length, but also in breadth, and there are many islands in its wide course.



The vast basin of the river Amazon and its many tributaries

Most of the rivers which drain the Brazilian Highlands descend over its steep margins in falls and rapids, and have their sources in the south-east of the Highlands. For example, the Paraná river is fed by several tributaries which rise in São Paulo state, within sight of the Atlantic Ocean, and flow north-west towards the interior to join the main river, before it continues on its southward journey to flow into the River Plate in Argentina. The São Francisco follows a remarkable course: rising in the south-east of the Highlands, it flows parallel to the coast for 1,000 miles before it turns east and descends the Paulo Afonso Falls to enter the sea, between Maceió and Aracaju.

Dense evergreen tropical forest on the banks of the Amazon

CLIMATE

Since Brazil stretches from the Equator to over 30° South, the climate of the country varies considerably. The Amazon basin has steadily high, though not extreme, temperatures; Manaus, for example, averages between 81°F and 84°F all the year round. Tropical thunderstorms bring heavy rain throughout the year, and the annual total is usually about 80 inches.

The climate gets colder the farther south, and the higher, one goes, and in parts there are even frosts. Rainfall is generally higher on the coast, reaching an annual average of 150 inches on the Serra do Mar.

COASTS

Brazil has a very long, narrow strip of coastal plain along the Atlantic Ocean. In the north is the mouth of the river Amazon, where the silt from the river turns the sea yellow for up to 200 miles out to sea. The mountainous coast of the south-east is particularly spectacular, and the former capital, Rio de Janeiro, is famous for its beautiful setting, with the Sugar Loaf Mountain rising majestically 1,296 feet above its harbour.

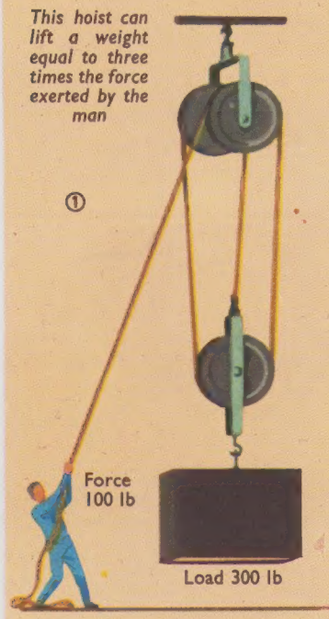
FACTS AND FIGURES

Area: 3,288,842 square miles
Greatest length: 2,700 miles
Greatest breadth: 2,700 miles
Length of coast: about 4,600 miles
Highest point: Pico da Bandeira, 9,462 feet
Longest entirely Brazilian river: São Francisco, 1,800 miles
Population: 70·5 million (1960)
Density of population: about 21 per square mile
Capital: Brasilia

PULLEYS (part two)

IN the first part of our article on pulleys (see page 2752) we saw that, by using a free pulley, we could lift a load equal to twice the force we used to pull on the rope. The system of one free pulley and one fixed pulley (to reverse the direction of the pull) had a mechanical advantage of 2. But it is possible to make up systems of pulleys which enable us to use much less effort than this to raise the same load. These systems, known as composite pulleys or hoists, will involve the use of more fixed pulleys and more free pulleys, and will have a mechanical advantage greater than 2.

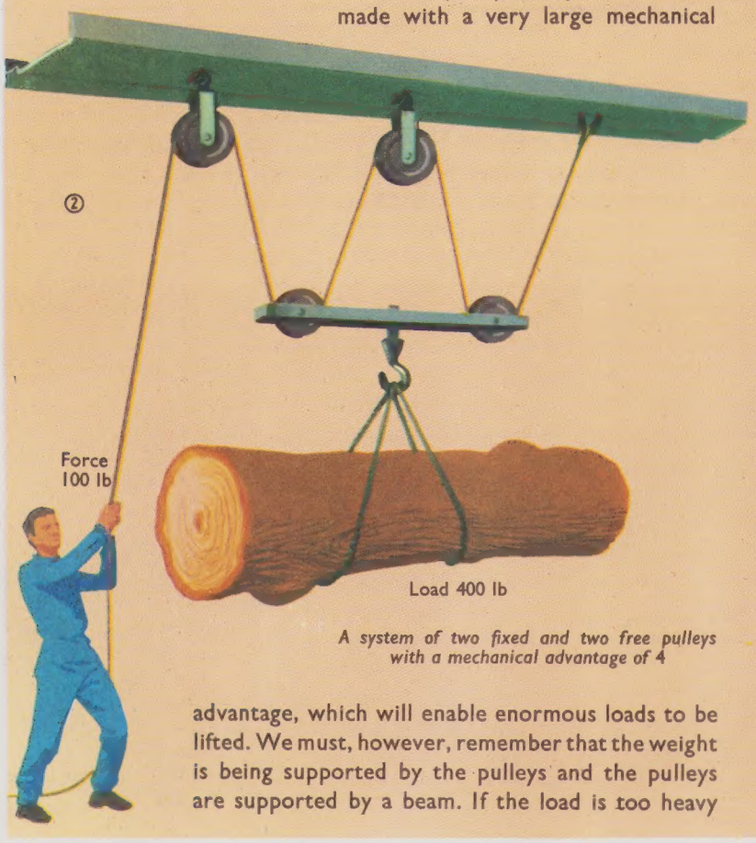
This hoist can lift a weight equal to three times the force exerted by the man



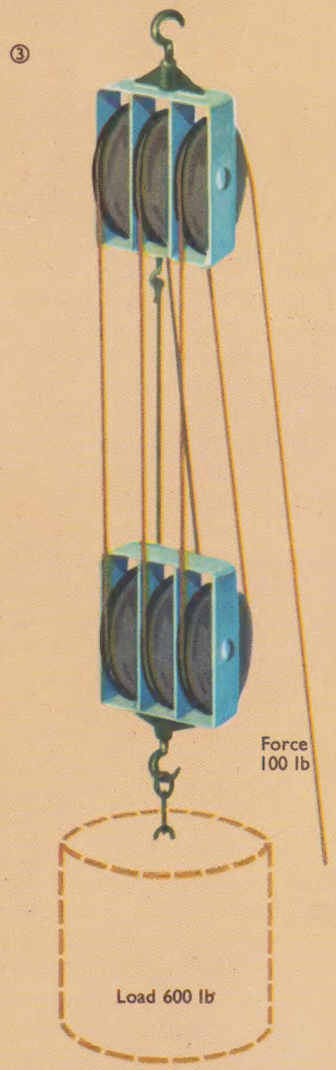
The system shown in the first picture on the left has two fixed pulleys and one free pulley. There are three sections of rope holding the load of 300 pounds, so each section will support 100 pounds of the total load. This means that the section the man is holding will only be supporting 100 pounds, and the man will only have to pull on the rope with a force of 100 pounds in order to lift the load. Using this system, a weight can be lifted equal to three times the force used to pull on the rope. The mechanical advantage is 3.

LARGE HOISTS

By increasing the number of fixed and free pulleys a system can be made with a very large mechanical advantage, which will enable enormous loads to be lifted. We must, however, remember that the weight is being supported by the pulleys and the pulleys are supported by a beam. If the load is too heavy it may break the beam, or the hook which attaches the load to the bottom pulleys. Illustration 2, below left, shows one of these more complex systems. In the previous example the load was supported by three sections of rope, and the pulling force needed was equal to one-third of the load. In this case, the load is supported by four sections of rope and the pulling force needed to pull up the load is equal to one-quarter of the load. As we saw in the first part of this article, a free pulley halves the effort needed to pull up the load, so two free pulleys will divide it by one-quarter.



A system of two fixed and two free pulleys with a mechanical advantage of 4

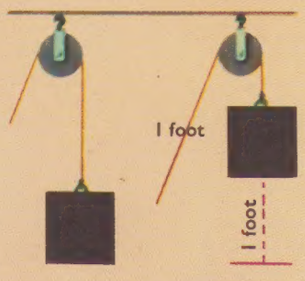


Hoists like the one shown in diagram 3 are used for such purposes as lowering lifeboats on ships. They consist of three fixed pulleys mounted side by side, and three free pulleys mounted in the same way. Since each free pulley on its own has a mechanical advantage of 2, the total mechanical advantage is 6. A weight equal to six times the exerted pulling force can be lifted.

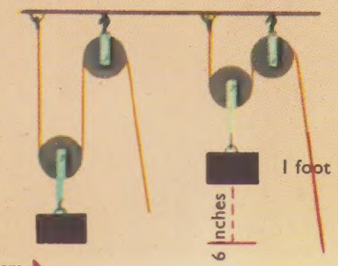
The 'rule' which governs these hoists is quite simple: to balance the load, one requires a force equal to that of the load divided either by the number of sections of rope supporting it, or by the total number of free and fixed pulleys if the pulling force is in the opposite direction to that in which the load is moving.

THE SAME WORK TO BE DONE

We saw on page 2752 that the pulley does not decrease the total amount of work done. Using the same pulling force, a much heavier load can be raised with a composite pulley than with a single fixed pulley, but it moves up more slowly. In the hoist with six pulleys, the load is raised one-sixth of the distance the free end of the rope is pulled down. But we measure the work done by multiplying the weight by the distance it moves. A small force pulling down a long way can balance a large load being raised a short way. This is the principle of the pulley.



A single fixed pulley system



A single fixed and free pulley system

Snails are not generally welcome in gardens, but they do not do as much harm as slugs. On the right: a snail laying its eggs

THE SNAIL

ALL through the winter the garden snails of Europe sleep – deeply, soundly, and completely. In the previous autumn they sought refuge in cavities beneath the roots of trees. Then they closed the mouths of their shells with a sheet of slime mixed with chalk, which hardened to form a door through which no enemy could enter unless it could break its way in. This door is called the *epiphragm*; it is slightly permeable to air, so that the animal can breathe just enough to keep alive, but hardly any moisture can escape through it. This is very important, for if the snail's body dried up during its winter sleep it would die.

As soon as the cold of winter gives place to warm, moist weather the garden snail in some mysterious way becomes aware that spring has arrived. It secretes some slightly acid slime, which softens the epiphragm, and pushes its way out of its shell. It will probably choose a warm, wet evening in April for its first venture outside after hibernation. Having slaked its thirst from the rain-soaked grass, it next seeks to satisfy its hunger on young and tender leaves. Seedling plants are growing up everywhere, some in the woods and hedges, some in the farmer's freshly sown fields, and some in gardens. Naturally the snail cannot appreciate the difference between wild and cultivated seedlings, and so it is disliked by gardeners, but there are seldom enough snails to do any real harm to agriculture.

Throughout the summer the snail comes out at night and hides during the day. If it appears during daylight hours it will probably be pounced on by a sharp-eyed thrush. Thrushes carry every snail they find to a convenient stone, on which they deliberately smash its shell, with repeated blows, before eating their victim. Often a particular stone will be found surrounded by fragments of snails' shells; such stones are known as 'thrushes' anvils'. A snail crawling in the open by day has a very poor chance of survival. Thrushes do not depend only on snails that venture out in daytime but seek them out in the crevices and undergrowth where they hide. Snails also have their nocturnal enemies, such as badgers and hedgehogs, and certain beetles, like the glow-worm, which are active at night and feed entirely on snails and slugs.

After the snail has met and mated with another of its species it is ready to lay its eggs, which it will do several times in the course of the year. For this purpose it digs a hole in the ground, and drops about a hundred small, white eggs into it. The baby snails that hatch from these resemble their parents, but their shells are thin and transparent and have fewer turns or 'whorls' than those of adult snails.

When we write about an animal we often treat it as a person and call it 'he' or 'she'. It is, however, impossible to give the snail a gender, because it is both male and female; the organs and functions of both sexes are present in the same individual. Animals which have this characteristic are called *hermaphrodite*. Nevertheless, snails need to mate in order to reproduce, because, in most species at any rate, the male and female organs do not become active in one individual at the same time.

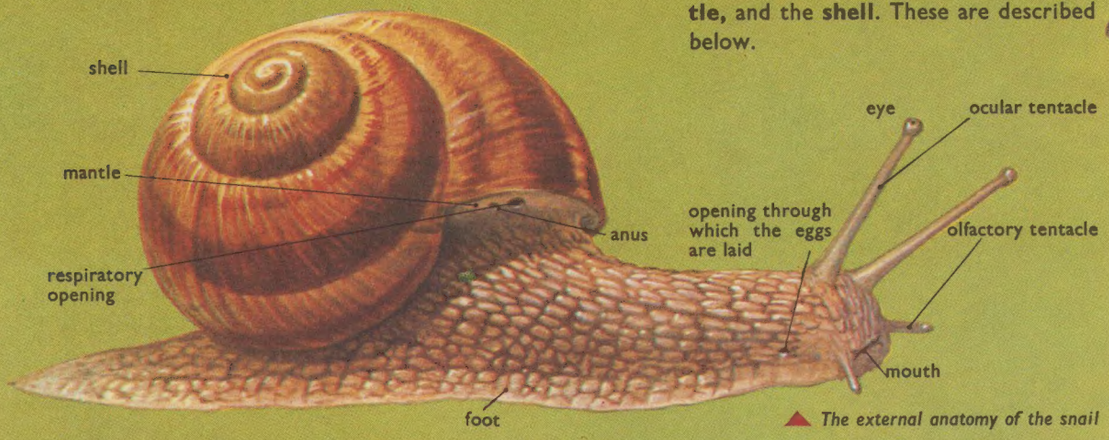
WHAT IS A SNAIL?

Snails are molluscs – that is, they belong to the Phylum Mollusca (see page 1148); and within the Phylum they are placed in the Class Gastropoda. Most of the land snails of temperate regions (and all the species we show here) are included in a Subclass called the Pulmonata or 'lung-snails', because they breathe by means of an organ very like a lung. There are, however, some temperate and many tropical land snails which are not lung-snails.

Generally speaking, snails like moist surroundings, and they are found in greatest numbers and variety in regions with high rainfall, though there are some species which live in deserts (see page 1309). Snails' shells are formed of calcium carbonate, or chalk, which they must obtain from their food. For this reason snails are nearly always most numerous in districts where the underlying rock formation is chalk or limestone.

EXTERNAL FEATURES AND ANATOMY

The three physical features characteristic of the snail are the **foot,** the **mantle,** and the **shell.** These are described below.



▲ *The external anatomy of the snail*

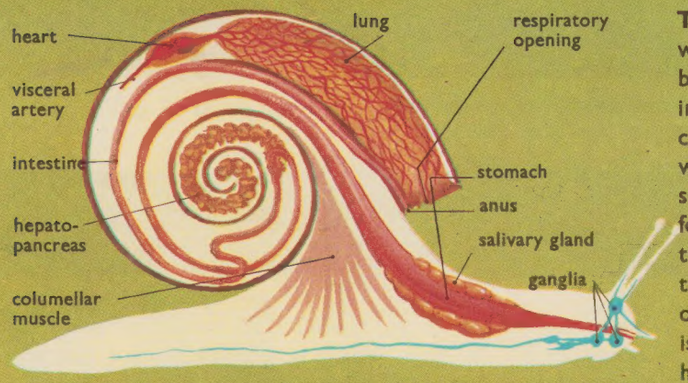
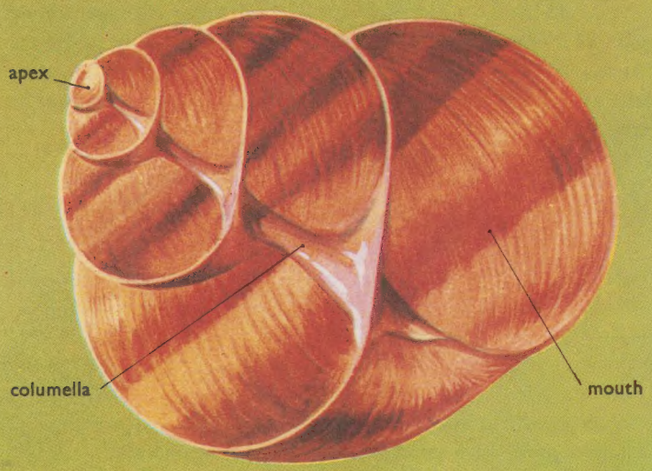


Diagram of the internal anatomy of a snail

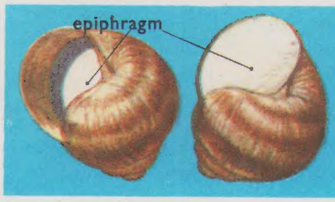
The foot. This is the part of the snail which you can see extended before and behind the shell when the snail is crawling. It is called the 'foot' because it consists largely of a muscular 'sole', which is in contact with the ground. The snail's head is at the front end of its foot, and bears two pairs of tentacles; the upper and longer pair have eyes at their tips, and the lower ones bear organs of smell. The mouth of the snail is in front, and on the right side of the head is an orifice through which the snail lays its eggs.

The mantle. The mantle is a fold of skin covering the part of the snail's body which contains its internal organs. It joins the foot at the opening of the shell, and between it and the fore-part of the body is a space called the mantle cavity. The walls of this space are coated with blood vessels; it opens to the exterior, and acts as a lung.



The shell. The snail's shell is secreted by the outer surface of the mantle, and consists mainly of calcium carbonate. It takes the form of a tapering tube, which is coiled in a spiral round a central axis called the *columella.* The spiral of most snails' shells (all those illustrated here) has a right-handed (*dextral*) twist; that is to say, the opening, or mouth, of the shell is on the right if you hold it with its apex (highest point) upwards, and its mouth towards you. There are, however, some species that have a left-handed (*sinistral*) twist.

◀ *Section of the shell of a snail*

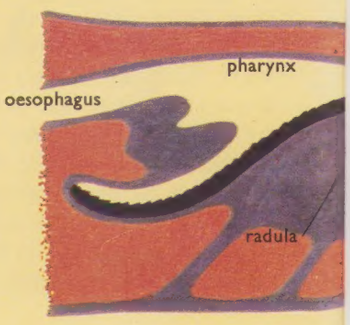


These two pictures show the epiphragm with which the snail closes its shell when it is preparing to hibernate. The one on the left belongs to a snail which has lost weight from lack of food; its epiphragm is well down inside the shell. The snail on the right, with its epiphragm level with the opening of its shell, is fat and well fed.

▲ **Garden snail** (*Helix aspersa*). This is the most common large snail found in Britain

A MOUTH WITH 20,000 TEETH

This sounds like an exaggeration or a mistake, but it is perfectly true. The 'teeth' of the snail are minute,



KNOWLEDGE NEWS

APRIL-JUNE 1964

LOOK—NO ENGINES!

Read about the do-it-yourself aviators

KNOWLEDGE NEWS 37, Hertford Street, London, W.1.
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Editor-in-chief: **John Chancellor MA** Editor: **William Armstrong BA**
Assistant Editor: **Christopher Falkus BA** Art Editor: **Paul Watkins**
Editorial Assistant: **Joyce Bentley**

Hello again! I suppose you are wondering why we have changed our name back to *Knowledge News*. The reason is simply that the use of the name *Far & Wide* for the supplement to *Knowledge* caused complications that we just had not bargained for. Anyway I hope you like the new *Knowledge News* as much as the old *Far & Wide*. We have certainly enjoyed working on it. But it is not always easy when we are in an office in the middle of London to keep in touch with your likes and dislikes. To make a good magazine one must have the co-operation of the readers, and that is why the bigger the pile of letters that greets us every morning the better satisfied we are. So although you will not be hearing from me for another twelve weeks, I am looking forward to hearing from you—soon.

The Editor

Women at work in East Germany

A HOLIDAY IN EAST GERMANY

Dear Editor, Many readers must now be thinking about their August holidays. I would like to tell you of a very interesting holiday I spent two years ago in East Germany.

My parents and I were visiting relations in East Germany, and the first place we went to was the police station where there were passport formalities and where we had to be registered. From there we went to obtain our food-ration cards !

A striking difference between East and West Germany was that there were female road-sweepers, gardeners, even builders, and tram-drivers. It would seem that there are not enough people living in East Germany to do all the jobs.

In railway stations you buy your ticket, but there are no ticket barriers whatsoever, and it would be quite possible to travel free of charge if a ticket inspector on a train missed you.

An astonishing thing was that a small orange could cost up to 5*s*, while pineapples, when they were available, cost anything from 15*s* each.

MARLENE STANIFORTH, 23 FOREST GATE, ANSTEY, LEICESTERSHIRE.

Sports Report from MARS

Dear Editor, The response by the Martians to your very impressive Earth XI published in your last issue has been typically supersonic. Over shortwave *radion* and speaking in Interlingua 9 (the only language understood by our Sheffield Space Receiving Station Monitors) the Director of the Martian Interstella F.C. (Mr G.H.Z.R.T. Orbscondita now aged 739 years) announced his Committee's tentative selection of their team to meet Earth at the next Solar Equinox (Augusta 67th 2705 AD). The match is to be played on the old Southern Cross ground now free of radiation after the unfortunate accident with the nuclear air-conditioning plant last season. The Martian Football League Committee reserves the right to replace any player without notice in the event of radiation sickness or collision with a meteorite (seven Andromedans lost antennae during their match against the Plutonians in the ninth round of the Orbit Shield last week and were carried off raving!) or any other mishap. Mr Orbscondita announced that the Martian Team, Mach 7, now head the League, with Mtero Sports in second place, and the USSR Space Station third. The USA Station plays only Baseball and jazz. The Martian Football League XI is as follows:

GOAL: **Metrelion** (*r.k.4*) (*Central Province*); L.B.: **Garth, Jun.** (*Interstella F.C.*); R.B.: **Sinistron, H.** (*Mtero Sports*); L.H.: **Karsch, Rob.** (*Venus National*); C.H.: **Terrapini, X.** (*Ursa Major*); R.H.: **Pheww, T.** (*Mach 7*); L.W.: **Nebula, Y.** (*Via Lacta*); I.L.: **Qillswbx, G.** (*Andromedans*); C.F.: **Icarus, D.** (*Plutonian Wanderers*); I.R.: **Zimitrex, J.Y.G.** (*Uranus F.C.*); R.W.: **Krewtchenko, N.** (*USSR Space Station*).

JOHN COLLIER, 10 CONDUIT ROAD, SHEFFIELD, 10.

I protest! Icarus has wings and Metrelion is a robot. Anyway the Southern Cross is a dangerous ground. Such is the force of gravity there that many promising players have gone into orbit and have never been seen again. Why not play at Wembley? I say: **'A square deal for our Earth lads!'** *The EFA should act now. The eyes of the Universe are on it!—Editor.*

A GREEN UFO

Dear Editor,

Some time ago I was in the garden with my brother and mother. I looked up at the sky and saw a coloured sphere. It was a bright green and it looked as if it were made of metal. It was moving fast, and by the time I had shouted to my companions it had disappeared behind the pear trees at the bottom of the garden.

I saw another one of them as well (this time silver) at school. It was going in the same direction as the other one. I know they were not dreams because mother remembers that day in the garden as well. In your last issue there was quite a lot about UFOs. Do you think I have seen a couple?

Stratford Caldecott (10), 19 Turney Road, West Dulwich, London, S.E.21.

BLOODTHIRSTY NED

Dear Editor, Ned Kelly was Australia's most cunning, notorious, and bloodthirsty bushranger, who lived during the gold rush days. He grew up in the bush country in New South Wales. At the age of 24 he and five others began horse and cattle stealing. When three policemen were sent to arrest Ned's brother, Ned and his gang ambushed and killed them.

The reward offered for Ned was raised to £8000 as a result of this.

Bank robberies were Ned's speciality. In the town of Euroa, Ned took £2000 in a daring raid in broad daylight. In the township of Jerilderie, Ned and his gang seized control of the police station, taking the police prisoner. After spending a quiet Sunday, Kelly's gang robbed the bank and then retreated into the bush.

16 months later the Kelly gang occupied the small town of Glenrowan. They had the railway lines torn up so that a police convoy coming in would be wrecked. However, the schoolmaster slipped out of town and warned the oncoming train.

Besieged in the Glenrowan Hotel, the Kelly gang fought boldly for 48 hours. The police saw Ned Kelly advancing in armour made from ploughshares. This covered his head and body and weighed nearly 100 pounds. They fired at his legs and brought him down. Then they set fire to the hotel and killed the remainder of the gang.

Ned himself was hanged at Melbourne on 11th November 1880 at the age of 26. His last words were: 'Such is life.'

KERRY ANN WALKER (AGED 15)
27 REECE AVENUE,
KLEMZIG, SOUTH AUSTRALIA.

DID YOU KNOW?

Dear Editor, The pearl is one of nature's masterpieces, but there is one pearl which stands apart from the rest—the 'Pearl of Asia'. The Pearl of Asia is the largest single natural pearl in existence. It is a drop-shaped pearl 3 inches long and 2 inches thick. It was found in 1628 by a group of Persian divers. The Indian ruler, who built the Taj Mahal for his wife, also bought her this pearl. It is next found listed among the treasures of Ch'ien Lung, an emperor of China, with whom it was buried in 1799. It was stolen from his grave 101 years later. Eighteen years after this it turned up in Hong Kong as security for a loan. When the loan was defaulted, it was sold in Paris after the Second World War to an unidentified person for an undisclosed price. The present whereabouts of this pearl is not publicly known.

ALAN BRAY, 1 BRANDLING TERRACE, LEEDS 10.

Dear Editor, As you know in this country it is considered to be very rude to put your tongue out, but in Tibet you would be thought a very polite person.

When one Tibetan meets another Tibetan he does not say: 'How do you do?' Instead, he takes his hat off and sticks out his tongue, and at the same time pushes forward his left ear.

RICHARD JACKSON (10), 11 BOLSOVER GROVE, MERSTHAM, SURREY.

I would be tongue-tied!—Editor.

Why does 'love' mean 'nothing' in a tennis score?

The word 'love', which we use in tennis, is the English version of the French word *l'oeuf*, meaning 'egg'. L'oeuf is the French slang for 'nothing', because the figure '0' looks like an egg. Hence the famous tennis cry.

J. M. GREY, 24 KNOWEFIELD AVENUE, STANWIX, CARLISLE, CUMBERLAND.

It's the same idea as the English 'duck' (duck's egg) at cricket, meaning 'no score'—Editor.

Dear Editor, Do you know how the cobra got the mark on top of its hood? The story goes, according to Kipling, that the great god Brahm put his mark on all the cobras after the first cobra had spread his hood to keep the sun off Brahm while he slept.

MICHAEL SHAILER (10), DRUIDS LODGE, COBHAM, SURREY.

VOICES FROM THE PAST

YOU CAN'T keep the Beatles out of anywhere—not America, France, nor even mediaeval England. In an interview with Henry V in our Face to Face Competition, Mary Lane (11) of Crawley, Sussex, brought up the subject of the 'lads from Liverpool'. In reply the pride of the Lancastrians admitted to having a Beatle haircut, although he found the Beatles' 'lutes' to be 'of a rather strange fashion'.

In the competition we asked readers to compose an interview with any historical figure. It had to consist of a set of three questions and answers. First Prize in the British and Irish section of the competition (overseas entries are at present being judged) went to David Ayrton (14) of Waltham Cross, Hertfordshire. His interview was amusing and well written, and put Samuel Pepys in historical perspective without getting too involved in his history.

Two which ran it very close were those from Linda Harding (16) of Oxford and Colm Ryan (16) of Dundalk, Ireland. Linda chose Richard III, and Colm, Oliver Cromwell.

Colm elicited some gloriously characteristic replies from Oliver Cromwell. 'Any qualities I possessed, I received from God, and I think our successes were due mainly to Him, who acknowledged the righteousness of our cause and the evil of the enemy's, and by His guidance I was enabled to establish an outstandingly efficient army.'

One of the most original entries was from Susan Lee Taylor (15) of Ashtead, Surrey, who chose an unknown soldier of the First World War. She expressed quite movingly how the adventurous, light-hearted spirit of the soldiers soon changed to depression and horror.

The two other Third Prize winners were Mary Lane (11) of Crawley, Sussex, with Henry V, and Regina Goodall (13) of Stoke-on-Trent, Staffordshire, with Leonardo da Vinci.

One of the most popular choices was Julius Caesar, though he was, on the whole, painted in too bright colours: 'The Plebs adore me . . .' 'I expect to be assassinated fairly soon' . . . 'It is good fun watching Christians getting clawed to pieces by the lions . . .' were some of his bombastic remarks. John F. Kennedy of the United States and King Harold of England were popular as well. Many ingenious excuses were produced to absolve Harold from breaking his oath to William the Conqueror.

FIRST PRIZE of £5

(British and Irish section)

Samuel Pepys by David Ayrton (14), 110 *Holmesdale, Waltham Cross, Herts.*

Mr Pepys, if you had known that in later times your diary would be read by millions of people, would you have written all that you did?

Certainly not ! That diary was for my own private enjoyment, quite apart from the fact that nobody asked my permission. My wife will not speak to me now !

Did the Fire of 1666 completely change your way of living for a time until new houses and public amenities were built?

Not really. I worked on national jobs which had to carry on—but poorer people were left homeless and destitute. The smell of burning was so nauseating that I took a week's holiday.

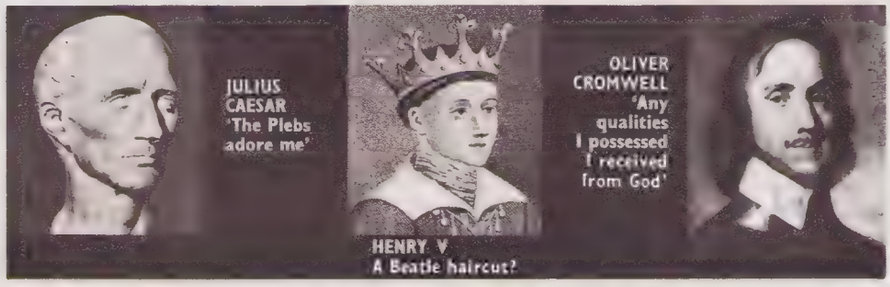
Lastly, if you had ten more years to live, sir, would you prefer to spend them now, in 1964, or back in the 17th century?

Oh, 1600! If I lived today I would not have such a good position in the management of the country's affairs. Also, I would have to obey the law much more now because of your concepts of justice. No, I much prefer the class distinctions of the 17th century.

OTHER PRIZE WINNERS

Second Prizes of £2: **Linda Harding (16), 1 Hutchcomb Road, Botley, Oxford; Colm Ryan (16), 11 Castle Road, Dundalk, Ireland.**

Third Prizes of £1: **Susan Lee Taylor (15), Little Bridge, 67 Broadhurst, Ashtead, Surrey; Mary Lane (11), 118 Worth Road, Pound Hill, Crawley, Sussex; Regina Goodall (13), 49 Frederick Avenue, Penkhull, Stoke-on-Trent, Staffordshire.**

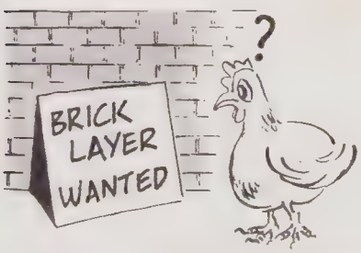


National Portrait Gallery (detail)

Laugh

'What do we do? Fight them or milk them?'

R. Salter, 3 Nile Street, Oakfield, Cwmbran, Monmouthshire, S. Wales.



Brian Mills, 2 St. Helen's Corner, East Farleigh, Maidstone, Kent.

Mother: **'Billie, you must not say that word again.'**
Billie: **'Well Shakespeare says it.'**
Mother: **'Then you must not play with him again.'**

Margaret Doherty, Primrose House, Dalrymple Road, Musselburgh, Midlothian.

Notice: FOR SALE—BULLDOG, EATS ANYTHING; VERY FOND OF CHILDREN.

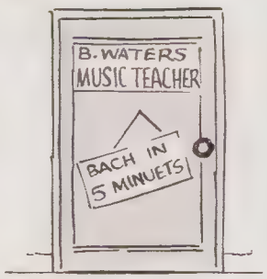
Michael Dessau (13), 57 Dunster Road, West Bridgford, Nottingham.

Husband: 'Did you find a good parking place, dear?' *Wife*: 'I parked the car where it said, "Fine for parking".'

Bhupendra Patel, GPO Box 500, Suva, Fiji.

A man walked into a restaurant and asked for a bowl of soup. When he received it he called the waiter and said: 'There's a fly in my soup.' To which the waiter replied: 'What do you expect for 9d, the Beatles?'

Keith Lamb, 9 Rowan Place, Chesterton, Newcastle.



Mary Lane (11), 118 Worth Road, Pound Hill, Crawley, Sussex.

Breakfast in bed

Alan Darbyshire, 8 Trent Close, Rawhill.

Any More Jokes?

If you have any more jokes send them in to us. We will pay 10s for each joke published in KNOWLEDGE NEWS. So let's hear from you as soon as possible.—Editor.

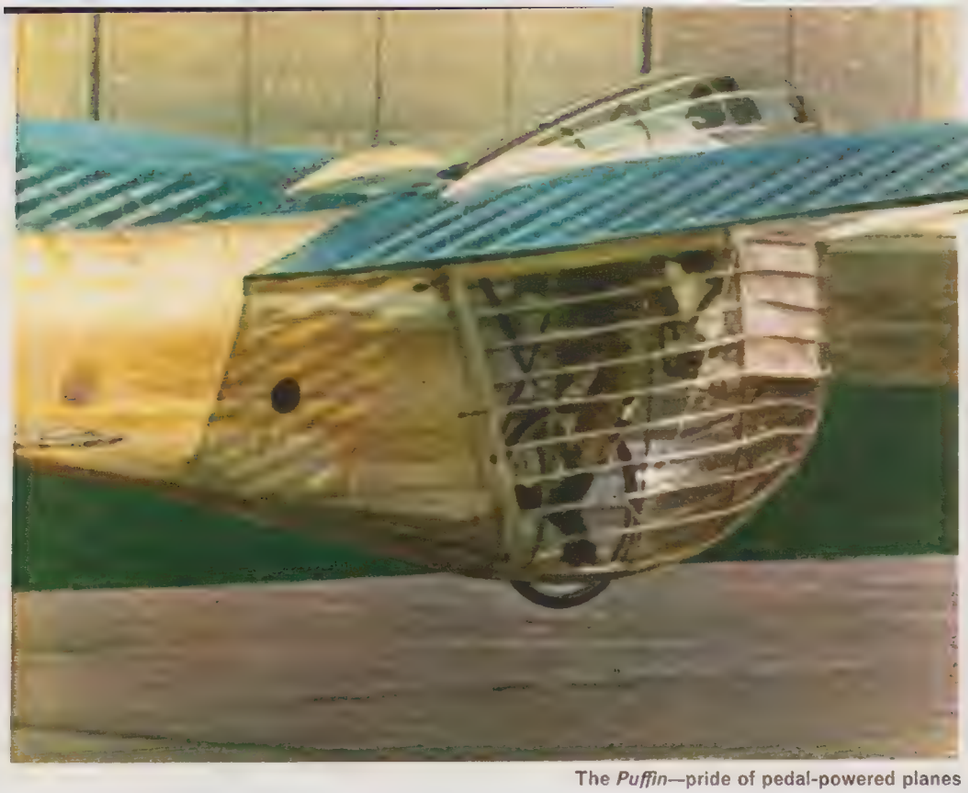
How Much Do You Really Know About Yourself?

1. How much of you is water?
2. How many bones have you?
3. How many hairs have you on your head?
4. How many pints of blood does your body contain?
5. How much iron does your body contain?
6. How much does your brain weigh?
7. How many times will your heart beat during your lifetime and how many gallons of blood will it pump?
8. How many glasses of water a day do you need?
9. What are the only parts of your body without hair?
10. How fast do your nerve impulses travel?

ANSWERS

1. 17/20ths of the weight of the human body is water.
2. The human skeleton is formed of 206 bones, but many people may have up to a dozen small bones in various parts of their body.
3. On a healthy head of hair there are at least 100,000 hairs and they grow at the rate of 9 inches each year.
4. The body of an adult contains between 10 and 12 pints of blood in which there are suspended 36,000,000,000,000 red blood corpuscles.
5. 1/5th of an ounce of iron or enough to make a 3-inch nail.
6. The average weight of a man's brain is 49½ ounces, about 5 ounces greater than that of a woman.
7. During an average lifetime the human heart beats 2,500,000,000 times to pump out 50,000,000 gallons of blood.
8. To keep an adult human in good health five glasses full of water are needed each day.
9. The palms of the hands, the soles of the feet, the backs of the last phalanges of the fingers and toes, the ear-drums, and the cornea.
10. Nerve impulses are conducted along large nerves at speeds of up to 250 mph.

LOOK



The *Puffin*—pride of pedal-powered planes

CAMERA PRESS

Men have always envied the birds their ability to fly. Some have tried to imitate them, often with disastrous results. Nowadays the jet airliner and space rocket can outstrip the performance of the fastest bird—yet there are many hundreds of enthusiasts who still prefer to fly 'naturally', using wings and the air rather than the engine. Let's look at some do-it-yourself aviators past and present.

This French marquis tried to fly over the river Seine in 1742. He landed with a crash — and was lucky to get away with a broken leg

The illustrations of flying machines were provided by the Rank Organisation from a film in their *Look at Life* series called BIRDMEN.

This curious pedal-powered machine was fitted with bird-like wings. It flapped them - but with little effect

A 'bird' that never learned to fly. A dramatic moment as this machine, built rather like a Venetian blind, imitates its namesake and folds up

– NO ENGINES!

Sky-divers not only lack engines—they also lack wings! The diver jumps from his plane and may fall one mile before opening his parachute (at this moment he may be travelling at 120 mph). If he delays opening until below 2,000 feet he will be in real trouble. Two enterprising producers had the idea of making a film with sky-diving scenes. All that was needed was one intrepid cameraman and two actors with nerves of steel. In our pictures here and on the cover the sky drama unfolds. Two actors grapple in a life-or-death struggle as they hurtle downwards with their attendant cameraman. None of the actors could be blamed if they were more worried about the performance of their parachutes than their own performance in the film

Far from soaring like a bird, the French cyclist, Poulain, cannot even clear a fellow cyclist who gets in his way. Both end up where they started—on the ground

Success! The makers of the Trident airliner built an elaborate man-powered bird. It weighed a mere 118 lbs and was called the Puffin. Powered by pedal, propeller and a great deal of effort the Puffin's pilot flew for a distance of half a mile—further than any 'human bird' had done before

'I was out in the fields during the winter, trying to get some of the cattle in, when suddenly I heard a noise. I turned round, and there, standing against the wall of stones that ran round the field, was one of the strange creatures. It was tall, standing on its hind-legs, it was very bulky, and had a hairy body. The hair was a reddish brown, and it mainly hung from the chest. The face itself was bare, there was no hair on it.'

This was how a nephew of the famed Everest guide Sherpa Tensing Norkay described his encounter with . . .

THE ABOMINABLE SNOWMAN

IT WAS in the early 1800s that Western civilisations first heard of the existence of a strange, hairy, man-like creature which lived high up in the snows of the Himalayas. Since that time it has been the subject of as much investigation and comment as the Loch Ness Monster in Britain.

The Abominable Snowman was given its rather pleasing name by a journalist in Calcutta towards the end of the last century. The Tibetan name for the creature is 'Midji Congmie'—or 'man-like creature from the snows'.

The biological evidence usually offered as proof of the existence of the Snowman—or Yeti—is scant. The scalp, once thought to have come from a Yeti, is now believed to have been moulded from the skin of a serow—a member of the goat family found in the Himalayas. The bones of the Yeti hand in the Pyngboche Monastery are almost certainly human.

One of the mysteries not so easily explained is the weird dog-like howling noise which the Yeti makes. But by far the most exciting pieces of evidence in the Snowman's favour are the tracks. These have been seen by several observers at different times. Dramatic photographic evidence of a Yeti trail came to hand in 1952. On the Everest reconnaisance survey (which preceded the 1953 climb) Eric Shipton took the remarkable pictures reproduced on this page.

The tracks were newly made, and there had been very little melting of the snow in this area. Shipton followed the tracks down the glacier for a couple of miles, and as the snow thinned the real impression of the foot became clear. Each print was about 12½ inches long, and the toes were clearly defined. There was a long, thumb-like toe, a long toe next to it, and three smaller toes bunched together on the other side. Sir John Hunt, leader of the successful Mount Everest Expedition in 1953, says that he has believed in the existence of the Yeti ever since he first saw its tracks in 1937.

The outstanding feature of the tracks which Shipton photographed is the fact that they had only just been made when he discovered them. Had Shipton missed a face to face encounter with the Snowman by only a few minutes? These photographs tend to counter the anti-Yetists who maintain that 'Snowman tracks' are formed by the melting together of several dog or fox prints. Also significant is the fact that the footprints show no evidence of claws—they could therefore not have been made by a bear.

Eye-witness accounts

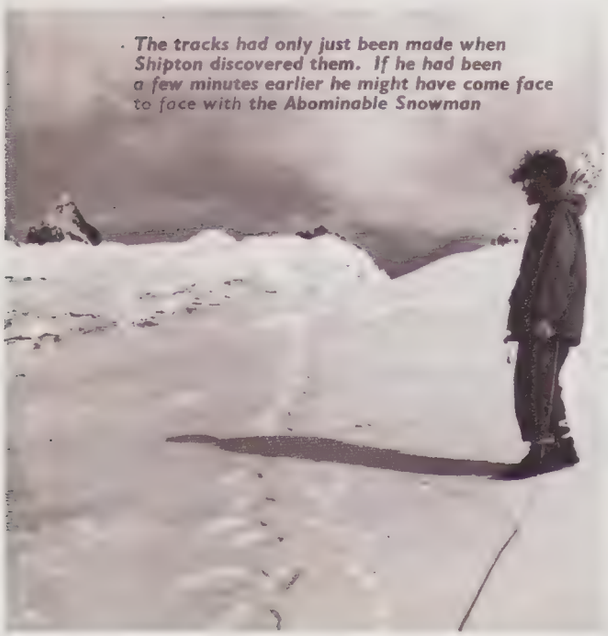
Despite the lack of concrete evidence either in favour of or against the Yeti, we can still get a good idea of what the creature looks like—if it exists—from the descriptions given by people who claim to have seen it. But probably no accounts are quite so exciting as that given by Sherpa Tensing Norkay's nephew printed above. The creature, according to reports, is between 4 and 6 feet in height and somewhat resembles an ape clad in reddish hair. It walks upright, but will travel on all fours in a typical ape posture when the need arises. It ploughs through snow-drifts using its arms in a swimming motion—exactly as a human being would do. It sometimes builds nests of juniper bushes woven together—gorillas and chimpanzees are known to build nests. When it is angry or annoyed it will tear up tufts of grass—another characteristic of gorillas and chimpanzees. These features of the Yeti and its behaviour have all been described by people who have never seen a gorilla or a chimpanzee, and who can know nothing of their way of life or habits.

But if the Snowman does exist, what relationship does it bear to man? It is probably a primate, but unlikely to be a close relative of man. It could be descended from a branch of the primate stock which separated before the first Ice Age from the line which eventually led to man. From the descriptions given by many Tibetans it appears to have many habits of an Ice Age creature.

There is little doubt that a creature like the Yeti could survive 14,000 feet up in the Himalayas. There is plenty of vegetation at this altitude, and a small mammal called a mouse-hare is plentiful. The Tibetans say that the Yeti kills the mouse-hare by hitting it against a rock and then disembowelling it. The yak, another Tibetan animal, is found in even more sparse and remote areas up to 20,000 feet, yet manages to survive the bitter conditions.

Could it be that the Abominable Snowman has remained unaffected by the climatic and other changes on Earth since the time of the Great Ice Ages? It is not impossible.

Geoffrey Marsh



The tracks had only just been made when Shipton discovered them. If he had been a few minutes earlier he might have come face to face with the Abominable Snowman

Photos: The Mount Everest Foundation

One of the mysterious 12½-inch-long footprints discovered by Shipton—was this the footprint of the Abominable Snowman?

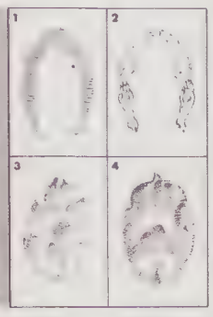
Another set of tracks so mysterious that they have been called . . .

The Devil's Footsteps

'The superstitious go so far as to believe that they are the marks of Satan himself!' This is what *The Times* wrote about the footprints of the strangest animal ever to visit Britain. In deep snow it walked across a large area of south Devon on the night of 8th February 1855. Its prints were extraordinarily sharp in outline, 'cut like a diamond or branded as with a hot iron', and they measured 4 inches long by 2½ inches wide. They travelled over the ground, scaled high walls, walked along them, and passed over roof tops. They appeared to hesitate at cottage doors but, never once resting, passed quickly on. In one instance they stopped by a haystack, only to reappear mysteriously on the other side. Strangest of all, the prints were invariably in a straight line, one after the other. Man's prints, of course, 'straddle' from side to side. In fact, there is scarcely an animal alive which makes its tracks in a straight line, and certainly there is none that can travel along roof-tops and walls. In its journey between Torquay, Newton Abbot, Teignmouth, Luscombe, Dawlish, Starcross, and across the Exe Estuary (how?) to Lympstone, Topsham and down to Exmouth, it must have travelled over 100 miles. To do this in one night it must have taken 10 steps per second!

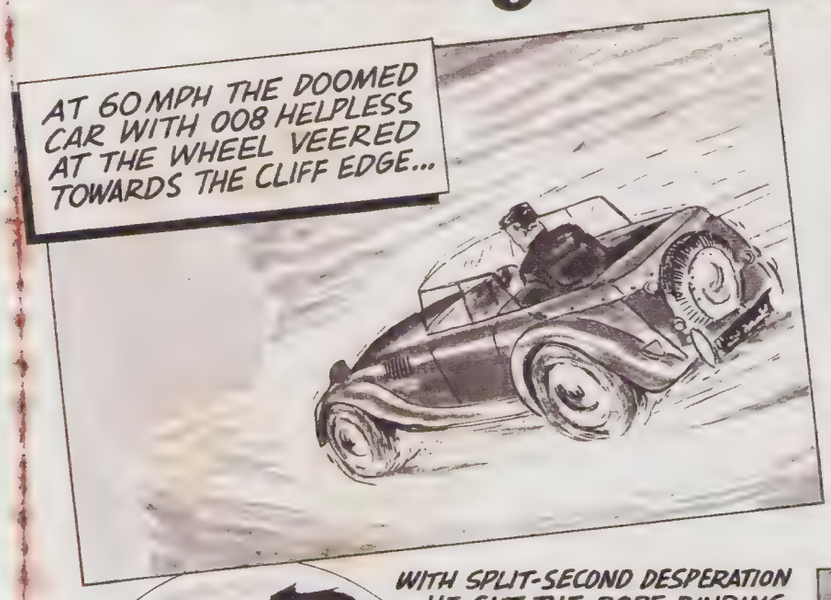
Moreover, though many 'candidates' were put forward such as leaping rats, otters, badgers, and even kangaroos and raccoons, the prints were unlike anything that had ever been observed. If anything, their resemblance was to the hoof of a donkey, which was obviously ruled out. What else was there? People began to wonder what sort of prints a man would make if he had the legs of a goat . . .

To this day the prints remain a mystery. And in the lonelier parts of Devon there are still those who bar their shutters, fasten their doors, and pray for deliverance as the wind rises on a winter's night, the snow falls, and 'the Devil rides'.



The mysterious footprints (1) bore no relationship to those of any living creature. such as: (2) footprints of a leaping rat; (3) prints of an otter's hind foot; (4) prints of a badger's hind foot

Strictly Make-Believe



A car hurtles towards a cliff-edge at 60 miles an hour. . . . The driver, his hands and feet tied, is trapped behind the wheel, confronted by imminent oblivion. . . .

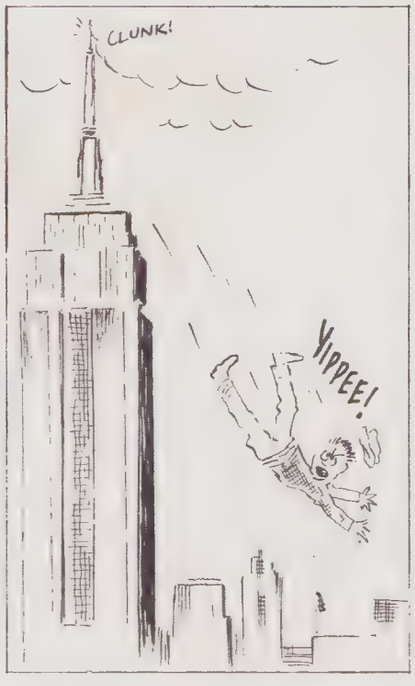
How fortunate for him that he is none other than Special Agent 008 (Yes, even Bond was mortal) and that he is prepared for such a situation. With his mind working like a precision instrument he edges the razor blade from the strap of his wrist watch, severs the rope binding his wrists and wrenches open the car door. Thwarting death by a hair's breadth he flings himself from the plunging, doomed vehicle. . . .

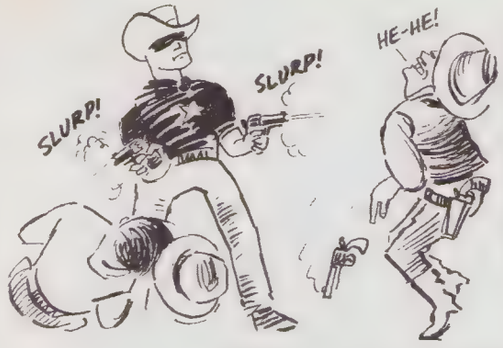
It has happened countless times, in equally countless copies of our favourite comic papers. Basically the same situation—but with unimaginable variations: the hero hanging by his fingernails from the window of a burning skyscraper; floating with a shredded parachute through bursting flak; lying in the path of a herd of stampeding cattle. And basically the same solution, with suitable variations: rescue by helicopter, haystack or high tree, conveniently placed at our hero's disposal. Sometimes it's purely the hero's own ingenuity which extricates him from catastrophe (viz 008), but one can be sure that he'll scrape out of it somehow. That much is as predictable as the situation—but how much are we really expected to believe? Comics are popular because they give full play to the imaginations of their readers, but in all fairness to them (in case they have visions of emulating 008 in father's car) we thought we might perhaps make a critical examination of the miraculous escape of our Special Agent. . . .

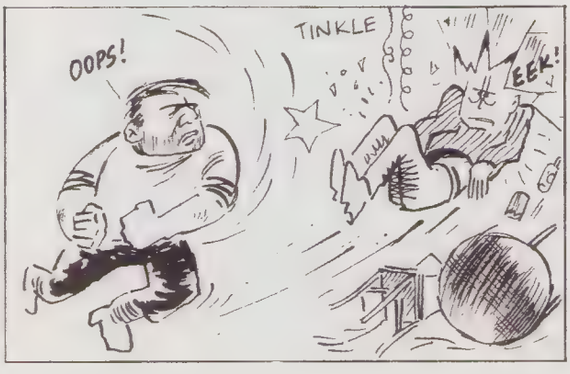
WITH SPLIT-SECOND DESPERATION HE CUT THE ROPE BINDING HIS WRISTS...
ICY KNOTS TIGHTENED IN 008's STOMACH AS HE FELT FOR THE RAZOR BLADE IN HIS WATCH STRAP...

To free himself, 008 would need the following minimum time:
To locate and extract razor blade: 2 seconds. To cut rope around wrists: 2 seconds. To open car door and jump out: 1 second. Total: 5 seconds.
Judging from the top picture the car is approximately 20 feet from the cliff edge. If it is travelling at 60 mph it will reach the edge in approximately .22 of a second. It would seem that 008 has a long way to go to catch up on that fraction of a second. By the way, a man jumping from a vehicle travelling at 60 mph with his legs tied would almost certainly kill himself.

What would you say if you fell off the Empire State Building? AIEEEEEEEEEEE (etc)? GOSH? OOPS? WOW? Probably none of them. We offer prizes of £1 for the most devastatingly realistic or the most hilariously unrealistic comic noises submitted to us and published in **Knowledge News**. Below are a few noises (a little *un*realistic) to start you thinking.







THE MASTER OF ART DEALING

Joseph Duveen (left) with some of his wealthiest clients. Centre: *J. P. Morgan, financier of governments;* above right: *Andrew Mellon, the enormously wealthy banker and United States Secretary of the Treasury;* below right: *Randolph Hearst, controller of the world's largest newspaper chain.*

TO be a client of Duveen it was often necessary to be more than just a millionaire. For a million dollars did not go far in buying some of the wares that Duveen had to offer. Only the inner circle of top bankers, only the owners of miles of railroad track, of acres of steel works or oil wells, of chains of department stores or newspapers could afford them.

Lord Duveen was perhaps the most fabulous art dealer ever. His grandfather was a Dutch blacksmith; his father, Joseph, and uncle, Henry, were both well-known and successful art dealers. Uncle Henry was a friend of King George V, Tsar Nicholas II, and some very important American millionaires.

But when the young Joseph entered the House of Duveen, he was far from satisfied with its already considerable success. He was not interested in his father's trade in furniture, tapestries, screens, and other objects of minor art. He was going to trade in real art—paintings and sculpture.

Joseph senior and Uncle Henry watched bemused as the young tornado transformed the House of Duveen, dispensing the hard-earned Duveen millions on wholesale purchases of famous art collections. In fact, he spent over £2,500,000 on three collections. These monumental gambles were to yield a handsome profit in years to come.

In 1919 Uncle Henry died, and Joseph became master of the House of Duveen. (Joseph senior had died in 1908.) From his Uncle Henry he had inherited a promising crop of millionaires like J. P. Morgan, perhaps the foremost banker in the United States. He began to cultivate them assiduously, at the same time adding others to the exclusive list of clients who called at his premises in New York's Fifth Avenue.

Duveen once said: 'If I had the Sistine Chapel I could sell it tomorrow half-a-dozen times over.' This was almost true. American millionaires of this period were looking out for great art—really great art, and there was money to pay for it in plenty.

These men wanted pictures for many different reasons: some because they liked them; others because they were a good investment. Pictures were much more of a status symbol than yachts or houses, and cost much less to maintain.

Other millionaires liked feeling part of history, owning what were once the prized possessions of Europe's greatest families: Italian princes, French courtiers, English dukes. Indeed, not only had they a foot in history, but also a stake in the future, for the fame of a Rembrandt or a Raphael would live on, and with it the name of its owner, long after his trusts and industrial empires were forgotten.

But there were some—men like Andrew

H. E. Huntington Art Gallery, San Marino, California

'THE BLUE BOY' *by Gainsborough (1727-1788)*

Perhaps Duveen's most famous purchase—he sold it for $600,000

Mellon—who were so rich, so powerful, and so aristocratic, that they were quite above status symbols. Their lives became dominated by a quest for what was more often than not unobtainable—the greatest art. Sometimes, however, this could be obtained at a price, and often that price was Duveen's.

Among all these financial giants Duveen moved with ease. They seldom got the better of him. His technique of salesmanship was brilliant. His extravagant and colourful personality, his charm, his wit, the enthusiasm with which he described his pictures, the scorn which he poured on those of his rivals, the air of knowledge which he imparted, the role he assumed of philosopher, mentor, and guide to the wonders of the artistic world, were all part of his salesmanship. His millionaires complained about his prices. He told them they should not quibble over the price of the supremely beautiful. They tried to beat him down in price—but he was prepared to wait for years for the prices he wanted. They went to other dealers, but they found Duveen had the best.

Perhaps the most spectacular of all Duveen's *coups* was for H. E. Huntington (railways). In the Californian millionaire's cabin in the *Aquitania* was a reproduction of Gainsborough's 'The Blue Boy.' Huntington liked it. Within a week Duveen had obtained it for him for $600,000.

One of Duveen's sales techniques was his reluctance to sell. Randolph Hearst (newspapers) once met Duveen when he was leaving his premises with Van Dyck's 'Henrietta Maria with Jeffrey Hudson and a Monkey'. Hearst had just had a difference with his wife, and in his present mood, immediately fell in love with the picture. However, Duveen told him, as he was to tell many other clients, that the picture was for *his* wife. He could not possibly part with it. Hearst's interest grew. He had to have the picture. Eventually Duveen reluctantly and sorrowfully parted with it . . . for $375,000.

To his clients, Duveen gave the impression of omnipotence and omniscience. But most of them did not realise how hard he had to work to give it: how diligently he maintained his network of information about the activities of clients and his rivals; how carefully and minutely he planned his campaigns and meetings.

Perhaps the most fateful meeting in Duveen's life was in a lift at Claridges, where he met the fabulously rich Andrew Mellon, head of a banking empire, for some time United States Secretary of the Treasury, and who had paid $7,000,000 in one transaction to the Russian government for 42 pictures. The meeting paid off handsomely, for in one transaction Mellon handed over to Duveen $21,000,000—a price that must have staggered even Duveen.

It is not quite fair just to look at Duveen as an art dealer of genius. He made a valuable contribution to American art. In the National Gallery in Washington are the Mellon Collection, the Widener Collection, and the Kress Collection, all of which Duveen played a major part in building up.

For England, too, Duveen did much. He made large gifts to the Tate and National Galleries in London. For a time he was a Trustee of the National Gallery, and was made a Baron for his services to art.

Altogether Duveen gave away about £2,500,000 in benefactions. But it was not until 1937, two years before his death, that Duveen at last came out of debt. When he died he had £3,000,000 in the bank, and stock worth another £2,000,000. His large gambles and his immense confidence in himself had been justified.

National Gallery of Art, Washington D.C. Samuel H. Kress Collection

Above:

QUEEN HENRIETTA MARIA WITH JEFFREY HUDSON AND A MONKEY

by Van Dyck (1599-1641)

Hearst bought it for £375,000 after a difference with his wife, who remarked that when she was upset she bought a hat

Right:

'THE SMALL COWPER MADONNA'

by Raphael (1483-1520)

One of the really great Italian works of art that hung in Duveen's gallery. Duveen's speciality were Italian pictures, and in this he was helped by the great art historian, Bernard Berenson, who was on his payroll

The National Gallery of Art, Washington D.C. Widener Collection

Some people can see into the future, read your thoughts, and transmit theirs. Scientists are not yet able to explain this strange ability. It is known as

THE SIXTH SENSE

HOW would you like to meet a man who could read your innermost thoughts? A man, maybe, who could sense many of the incidents of your past life and who could see some of the events in your future? There really are people in the world with this ability: a strange *sixth sense* which provides them with information additional to that supplied by the five usual senses of sight, hearing, smell, taste, and touch.

Why some individuals and not others should possess a sixth sense, or as it is sometimes called, *second sight*, is not known. Nor can anyone say how the sense works in the few people who have this gift. Scientists have called it *Extra-sensory Perception* or ESP, for they regard it as a way of obtaining information without the use of the usual senses.

The most startling living example of a person with a sixth sense is undoubtedly the Dutchman, Peter Hurkus. He acquired his strange gift after a serious fall in which his skull was broken. Thereafter he could visualise a great deal about the past and the future of almost all the people whom he met. Not only this, he could often tell a great deal about a person merely by seeing and handling one of that person's possessions—a ring, a key, or some similar article.

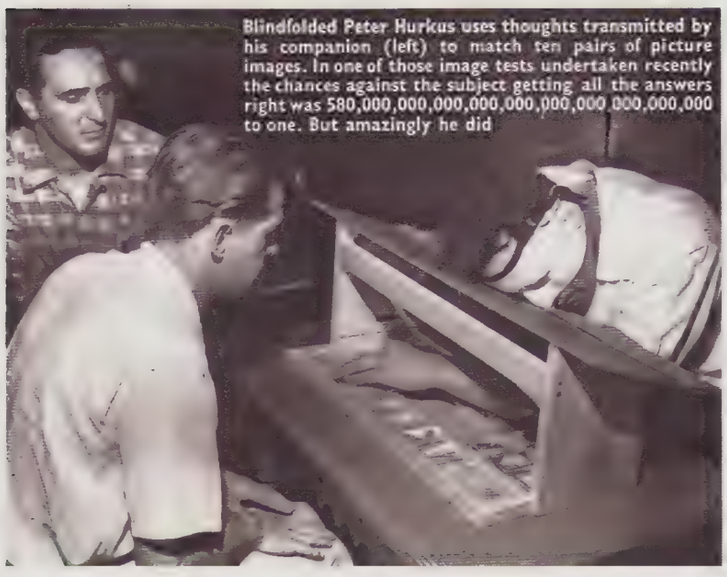
Attached to his companion by a rope, Peter Hurkus uses mental telepathy to guide him to a hidden fountain pen. The rope is used to sharpen telepathic abilities

In a light-hearted way Herr Hurkus has used his gift on the stage, but he has also on many occasions put it to much more serious use. He has helped to find criminals, to trace stolen goods and missing persons, and even to locate a fault in a mass-produced motor car. What is more, he has been thoroughly investigated by scientists. Their experiments with this remarkable Dutchman have confirmed beyond all doubt his possession of a most unusual faculty.

Though very many different kinds of experiment have been devised to demonstrate the existence of extra-sensory perception, those using cards are the most popular. Playing cards were at one time employed, but since many people have preferences for spades and sevens, these have been discarded in favour of cards bearing simple symbols. In the experiments a person known as a *sender* concentrates on a card in his hand while the person with the sixth sense, the *receiver*, tries to visualise the symbol on the card's face. Thousands of experiments of this type have shown beyond all doubt that, with a good sender, a receiver can visualise the symbol on the cards in the sender's hand far more often than could happen by chance alone. Even more interesting, however, is the fact that when the receiver gets a card wrong, his vision is often that of the card immediately preceding or following.

Ideas to explain the mechanism of ESP are legion. The doubters have often claimed it is nothing but trickery, usually practised for money, and it is certain that many cases of 'sixth sense' are just this. In the case of *telepathy*, or the ability of a receiver to tell what is in the mind of a sender, it has been suggested that waves or vibrations of some kind emanate from the sender's brain and are picked up by the brain of the receiver. Such a mechanism would explain how a receiver can tell the symbols on the cards on which a sender's thoughts are concentrated.

Telepathy might also account for the ability of a person with a sixth sense to learn of the events in another person's past, but it cannot, of course, account for *clairvoyance*, or the ability to guess the next card or to know of events which will happen in the future. Could this be some freakish behaviour of the dimension of time to which only a few people are sensitive? Only the future and many more experiments will tell. So far nobody, not even a person with a sixth sense, has been able to see that far ahead.



Blindfolded Peter Hurkus uses thoughts transmitted by his companion (left) to match ten pairs of picture images. In one of those image tests undertaken recently the chances against the subject getting all the answers right was 580,000,000,000,000,000,000,000,000,000,000 to one. But amazingly he did

ARE YOU TELEPATHIC?

Here are two ways of trying to find out. The simplest test is to have a friend go through a pack of cards with you one by one. He will pick up the cards so he can see the faces and you cannot. He should try and transmit to you whether the card he holds is a black or red one. You should try to guess whether it is red or black. Pure chance would give you a score of 26 (half the pack). But if you consistently score more than 34 correct you may well be 'sensitive' and possess extra-sensory abilities.

The second test is to get a friend to concentrate very hard on a card. Just think about cards in your mind; try to conjure up pictures of them. If you get a fixation on one card it may well be the one your friend is thinking of. This test can often produce the most uncanny results. In fact, the editor transmitted two cards running through to the assistant editor—much to their amazement. They only had two attempts, and the odds against getting the right cards were 2704 to 1.

HAVE ANIMALS A SIXTH SENSE?

There are certainly many strange happenings in the animal world which are not explainable in terms of ordinary knowledge. How, for example, can birds migrate many thousands of miles each year and unerringly return to the very nest they left behind?

Certain eels breed in Europe and North America, and their offspring invariably return to the Sargasso Sea. After this these eels return to Europe and North America to breed and then die. And their offspring, in some mysterious way, go back to the Sargasso Sea.

There are fish who lay eggs above the shore line. In order to do this they have to pick the very largest wave of the year which lands them on the beach. They lay their eggs before struggling back to return to the sea on the second largest wave, which, of course, does not disturb the eggs.

These fantastic instances could be multiplied many times over. What is certain is that such things cannot be explained with reference to sight, hearing, touch, smell, and taste.

The Editor talks to HAMLET

EDITOR:
Your Highness; you are the central figure of the most famous play in the world. To play you is the ambition of every actor. For centuries, your thoughts, actions, and motives have been debated in dressing rooms, class rooms, and in books. Have you any short explanation for the incredible interest you arouse?

HAMLET:
Each man finds in me the echo of himself.
My torment is the stuff of which is made
The troubles of humanity itself.
My self-elected task was not to win a battle or a queen,
But to choose between right and wrong,
And, having chosen, act.
I join alike with kings and beggars
In this common seeking of mankind.

E: Your character has, of course, aroused extraordinary controversy, but don't you think some of your critics are unfair? Do you think any other man in similar circumstances would have behaved so very differently?

H: *My father, whom I adored, was murdered by his brother, my uncle.*
My murdering uncle married my mother whom I worshipped.
The ghost of my father himself urged me to take my revenge
And make an end of his destroyer.
Can there be anyone who would not have taken God's law to himself
And resolved to avenge so foul a murder?

E: No, I am not suggesting that your critics accuse you of too much violence—rather not enough. Why *did* you hesitate so long and kill your uncle only when you knew that you yourself were at the point of death?

H: *That is the question.*
It is no easy thing to slay a man with your blood cold,
Your mind reflective, and your passions dulled.

E: Yet you killed Polonius.

H: *I was roused to fury by my mother's monstrous sin.*
Hercules himself I would have slain
Had he intruded upon such a quarrel.

E: And did you think it was your uncle behind the curtain?

H: *Oh, in my mind's eye, I saw his putrid body as I lunged it with my sword.*
Yet I had just left him praying and would rather answer
That I did not think at all.

E: You have not quite explained how, in spite of your anger, you hesitated so long about killing your uncle.

H: *I said I slew Polonius when I did not think.*
I did not think—and yet, in all, I thought too much.
I weighed, reflected, questioned;
My father's ghost had told me of my uncle's guilt,
Yet my resolve was such, I chose to verify his word
With play acting!
I wished my uncle dead yet debated my own suicide.
My mind was not at rest,
And only minds at rest, set, and settled on their course,
Can translate thought to action.

E: And in all this soul-searching and bitterness, how did you regard Ophelia?

H: *Very favourably.*

E: Why were you so cruel to her then? After all, it was your angry 'get thee to a nunnery' which drove her mad.

H: *Must I answer with a word?*
Are there not a score of reasons for the simplest act?
I loved her for herself, yet hated her for being a woman.
The treachery of my mother bred in me a loathing for her sex.
Again, I wished to let it get about that I myself was mad,
Distracted, and incapable of reason.
All this that my uncle might think me harmless,
For I suspected him of plotting my own death.
And, if you will, I was acting.
For no man has ever watched himself as I:
Wronged, tormented, despairing,
Had I not cause enough for madness?
So madness I feigned.

E: Shakespearian tragedy is said to be the decline and fall of a great man. Were you great?

H: *What is greatness? I was not great in battle, fame, or favour;*
Yet, I think a man's true greatness lies in his part
More than his performance of it.
None were ever more divorced in spirit and in deed than I,
But if my body had been made to suit my mind,
I could have done great things.
Therein lies what nobility I had—nobility of purpose and intent.

E: One thing which has always puzzled me. What exactly happened in real life when you were sent to England with Rosencrantz and Guildenstern?

H: *Our ship was never set upon by pirates,*
And nor did I at once return.
I reached England, and there met the king,
And, after some adventures it would take too long to tell,
Was sent to Scotland.
There I was to meet the dread Queen Hermuthruda,
Who brought death to every man.
But I won her heart, and her hand,
And so escaped.

E: Well, I see Shakespeare did not always check his facts. Tell me, what do you think of him as a writer?

H: *How can I speak of a man to whom I owe*
Not one lifetime, but four hundred years
Of bright enduring fame?
Who today does not know Hamlet
Yet who knows him outside Shakespeare's play?
These plays are the jewels of the English language—
The finest possessions of the nation.
To the wide world, they are England's greatest gift,
And among the past's great legacies to future man.

E: Do you believe in ghosts, your Highness?

H: *I do. I saw my father's ghost upon the battlements.*

E: But your mother did not, when you spoke to the ghost in her presence. Why was this?

H: *St Joan's captors never heard her voices,*
And were they then unreal?
My friend Horatio saw my father's ghost.
A spirit will not trouble to be seen or heard by those to whom
It has nought to say.

E: Which performance of yourself have you enjoyed most?

H: *Whom shall I say? Burbage, Irving, Barrymore, Gielgud, Olivier, and O'Toole:*
All these and countless more besides
Have strode the boards in my disguise.
The great are those whose aims combine
To play the poem, to speak the line.
For of Hamlet *I have this to say,*
'Tis the greatest poem and the greatest play.

The high-speed sport with no age limit

Karters jockey for position as they straighten out after a tricky piece of cornering. It takes considerable skill to negotiate the snake-like courses which weave between straw bales

HAVE YOU ever wanted to be a motor-racing driver? In Britain there are thousands of racing drivers who have never owned a racing car. Instead, they use a go-kart, one of the modern crazes in motor sport.

Karting is a sport for the amateur—the person who likes to spend his Saturday afternoons tinkering with a spanner and a screwdriver. The go-kart's engine is little larger than that of a lawn mower—but with a bit of hotting-up can do around 50 mph. And that feels extremely fast when you are practically sitting on the ground !

A complete go-kart is quite expensive, but much cheaper to buy in parts and put together yourself. You can get a set for about £70, plus the cost of the engine.

Karting came to Britain from America in the late 1950s. It was probably started by a Captain Flynn who brought his kart to Britain while serving in the United States Air Force. Since then over 80 clubs have sprung up in Britain, and more than 500 race meetings are held each year. These meetings are miniature versions of the real thing ! Each kart has its team in the pits who anxiously watch and listen for engine faults and study the form of rival machines. There are several classes of go-karts, just as in big-time racing cars. A race consists of 24 laps and usually involves weaving through straw bales on a disused air strip. The width of the track is 20 feet or more wide and considerable skill is needed to negotiate the winding snake-like course half a mile or more in length.

There is no age limit for go-kart drivers. The 5,000 or so holders of RAC track licences include boys of 12 and men of 70 !

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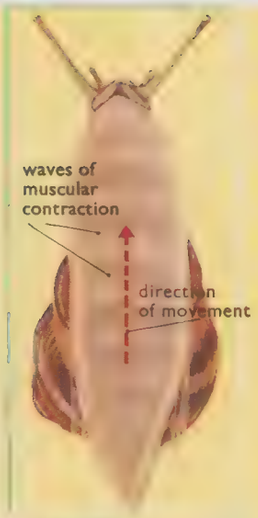


THE SNAIL'S PACE

The crawling of a snail is quite a complicated process. If you make one walk across a sheet of glass, you can see, crossing the underside of the foot, alternate light- and dark-coloured bands, which appear to be constantly moving towards the tail. Where a dark band appears, the skin of the foot is pressed against the glass. The muscles under the skin contract, and since the dark band is pressed against the glass and cannot move backwards, the body moves forwards. The skin is then lifted clear (making a light band) and moved forwards again. By repeating this type of motion all along its lower surface the animal crawls forward, supported on the rim of its foot, which acts like the skids of a sleigh. A gland near the front secretes mucus, so that it slides over a path of slime.

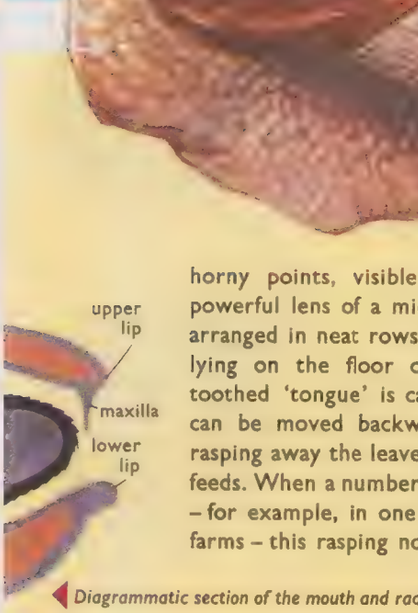
In France snails are eaten as a delicacy, and about 600 million of them are consumed every year. Some are just picked up like this on the hillside, but far more are raised on farms, on a diet of vegetables and bran

SOME COMMON SNAILS

Giant snail (*Achatina fulica*). This large snail is a native of Africa, but was accidentally introduced into Asia, where it is now regarded as a pest

Edible snail (*Helix pomatia*). Found in south-eastern England

Helix nemoralis. A small snail, prettily coloured and quite common



Diagrammatic section of the mouth and radula of a snail

horny points, visible only through the powerful lens of a microscope, which are arranged in neat rows on a band of tissue lying on the floor of the mouth. This toothed 'tongue' is called the *radula* and can be moved backwards and forwards, rasping away the leaves on which the snail feeds. When a number of snails are feeding – for example, in one of the French snail farms – this rasping noise is quite audible.

Slugs are closely related to snails, differing from them mainly in having no proper shell; a trace of the shell is present under the mantle. Slugs are quite a serious pest in gardens

FROM CONSTANTINE TO ROMULUS AUGUSTULUS

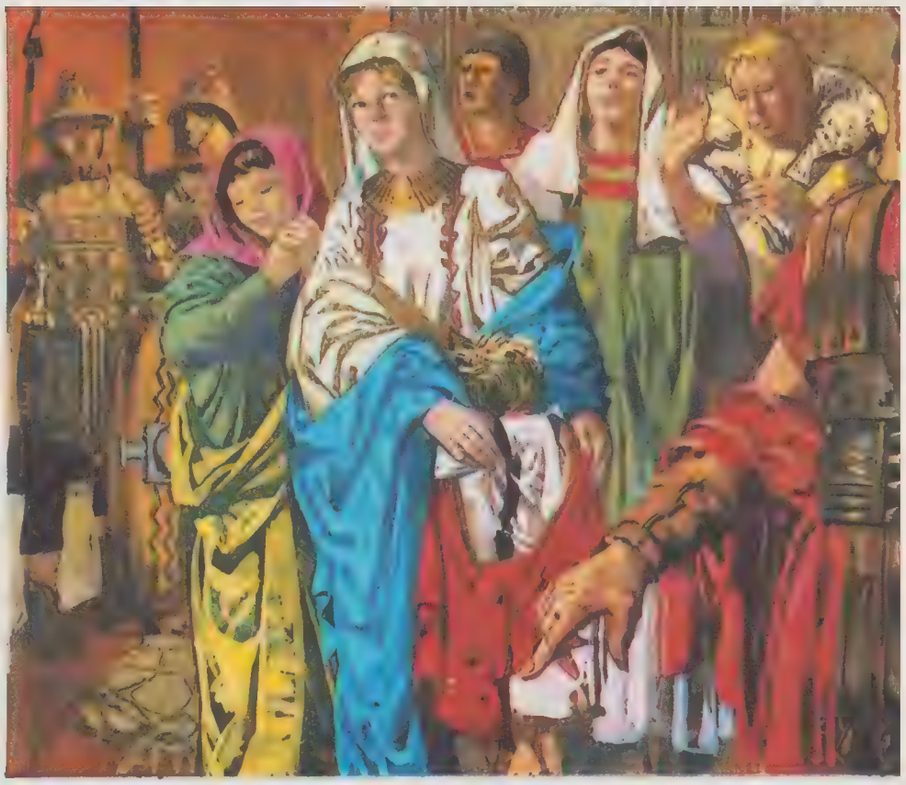
IN AD 363 the Emperor Julian the Apostate, leading his army against the Persians, was mortally wounded by a spear. With his last breath this Christian-hating Emperor cried out: 'You have conquered, O Galilean.' It was true, for Julian was the last Emperor to try to check the spread of Christianity and bring Rome back to its pagan past. From this time on, Christianity, which had first found favour 50 years earlier under the Emperor Constantine the Great (see page 672), became unquestionably the religion of the Roman world.

But this period is important not only in the history of Christianity; it was also the time when the two halves of the Roman Empire drifted farther apart. The east remained powerful, rich, and comparatively secure, mainly because its new capital, Constantinople (see page 562), was in a dominant position both for trade and for defence. The west grew gradually weaker, until in 476 the barbarian chief Odoacer actually deposed the Emperor Romulus Augustulus and ruled in his place. In theory there was only one Empire all this time, even when it had two or even three rulers. But, in practice, since the east and the west faced quite different problems, it often seemed as if they were two separate Empires.

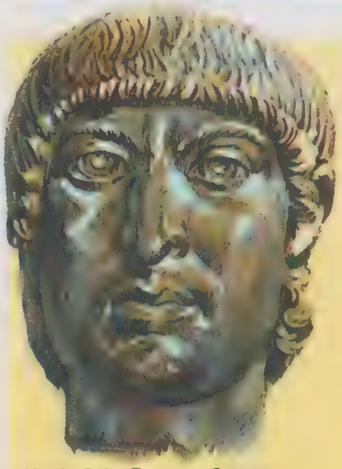
THE FIRST CHRISTIAN EMPERORS

When Constantine died in 337 he left the Empire to his three sons, confusingly named Constantine, Constantius, and Constans. Civil war followed, and in 350 Constantius was left ruler of the whole Empire. Constantius was a devout Christian, determined that his religion should triumph; and he persecuted the pagans in his anxiety to crush the old superstitions which were still strongly held. (It was not only the Christians who were persecuted in these times.) Constantius issued a decree forbidding people to use pagan temples, and made sacrifice to the pagan gods an offence punishable by death. He even went so far as to have the pagan Altar of Victory removed from the Roman Senate.

The triumphal arch dedicated to Constantine the Great in Rome



Imperial soldiers compel Christians to leave the



Head of the Emperor Constans, son of Constantine the Great

But, oddly enough, Constantius was not popular with many of the Christians, because the Church was divided at this time over its doctrine. Constantius was a follower of a priest called Arius, whose teaching, known as *Arianism*, was later declared heretical by the Church. So all those Christians who were not Arians were opposed to Constantius. But the real reaction against Constantius's excessive zeal in matters of religion came during the reign of the next Emperor, Julian, when the Empire briefly reverted to paganism.

JULIAN – THE PAGAN EMPEROR

Julian, who is known as 'the Apostate' because of his hatred of Christianity, was the last Emperor of the family of Constantine the Great. He was born in 332 and was, of course, brought up as a Christian; but early in his life he fell in love with Greek literature and philosophy, through which he came in the end to believe in the old gods – especially Helios the Sun-god. It is difficult to say exactly why Julian turned against Christianity. Perhaps one reason was the murder of most of his family by his Christian cousin, Constantius, who was afraid of possible rivals. Julian's youth was certainly spent in great fear of the Emperor; but in 355 Constantius, who had to provide for the succession, made Julian his Caesar (assistant ruler) and sent him to Gaul.

Julian was a very good general, and beat back the Franks and the Alemanni. He was so popular with his troops that when Constantius demanded reinforcements from Gaul for his Persian campaign, the troops refused to go and acclaimed Julian as Emperor. Soon after this Constantius died, and Julian was left as sole Emperor in 361. His reign, however, lasted only two years. He was killed in 363.

Golden coin of Constantine II

Golden coin of Constantius

basilica in the middle of their worship. On the right the bearded Emperor Julian observes the progress of his 'peaceful persecution' of Christianity

Statue of Julian the Apostate, who tried to stem the tide of Christianity and restore paganism in the Roman Empire

Julian did not make the mistake of openly persecuting his enemies, the Christians. Instead, he encouraged divisions within the Church (such as that between the Arians and their opponents), and prevented Christians from teaching in schools. He also tried to reorganise the pagan religion on more efficient lines, and in fact borrowed much of the organisation of the Christian Church for paganism.

But Christianity could not be checked now. The tide of history was against Julian, and paganism was finally crushed when Theodosius the Great became Emperor in 379. A devout Christian of Spanish origin, Theodosius attacked not only the pagans but also the 'heretics' – those Christians like the Arians, who did not believe wholly and exactly in the doctrine of the Church as it was laid down in the Nicene Creed. Theodosius's devotion and the power of the Church were shown in 390, when Ambrose, Bishop of Milan, forced the Emperor to do penance and admit his guilt for ordering the massacre of the people of Thessalonica. But while Theodosius was dealing with the religious question the Empire was also facing a renewed threat from outside.

BARBARIAN THREAT

The Huns, sweeping into central Europe from Asia, were pushing other tribes before them. And, as in the 3rd century, this invasion of barbarian Germanic tribes became the most dangerous threat to the Empire.

Theodosius defeated the Goths, and adopted the wise tactic of conciliating them and even enlisting them as allies in the imperial service. But when he died in 395, dividing the Empire between his two sons, Honorius and Arcadius, the western part declined; and from now on the east and west were the same Empire only in name.

THE 5TH CENTURY

Barbarian invaders moved in from the Balkans to attack Italy and the west. In the 5th century the west lacked rulers strong enough to resist them; it was only because of the energy of generals like Stilicho, himself a German, that the barbarians were kept out for so long. During this century the Empire lost its outlying western provinces – Britain, Spain, Gaul, and Africa. In 410 the Visigoths actually sacked Rome itself, and in 476 Odoacer deposed the last of the west's puppet Emperors, the young Romulus Augustulus.

The eastern Empire survived until 1453. But despite the efforts of certain Emperors such as Justinian (527–565), who temporarily recovered Italy and North Africa, the west was lost. Odoacer was followed by Theodoric the Ostrogoth, who founded a barbarian kingdom in Italy, with its capital at Ravenna.

Under the barbarian kingdoms (see page 1506) Italy ceased to be a centre of civilisation. The process started by Constantine was completed; Constantinople, capital of the eastern Roman, or Byzantine, Empire had now become the undisputed centre of European learning and culture.

A messenger from the barbarian Odoacer tells the young Romulus Augustulus that his master intends to depose him

POPES PIUS XII AND JOHN XXIII

IN 1963 an astonishing play was produced. It was called *The Representative*; its author was Rolf Hochhuth, its uncut running time was eight hours, and its theme was a bitter criticism of Pope Pius XII for indirectly causing the death of thousands of Jews by not openly condemning Nazi racialism.

The play's view fitted in well with many people's impression of Pope Pius – an impression which views this undeniably great man as, first and foremost, an astute statesman and able diplomatist. Such a view stems largely from the contrast with his successor, the progressive, very human, very humble, and immensely popular John XXIII.

Yet any contrast between the cautious and conservative statesmanship of Pius and the jovial liberalism of John is, in many ways, unfair. A closer study shows that Pius himself was a 'progressive' Pope and that John was fortunate to succeed a man who had so ably controlled the Papacy in what were perhaps the most difficult years of its many centuries of existence.

Achievements of Pius

Cardinal Eugenio Pacelli was elected Pope on 2nd March 1939. He took the name Pius XII. He was of a notable family with strong legal traditions, and a long history of service to the Papacy. Before he became Pope, Pacelli had been a distinguished Vatican diplomatist. He had had a large part in implementing the famous Concordat with Mussolini (1929) by which the Vatican was recognised as a sovereign state, and also arranged the Concordat with Germany after Hitler's accession to power.

Pacelli was elected Pope just a few months before the world was plunged into the Second World War. His own appeals for peace were in vain, and so, after September 1939, he found himself in the most extraordinarily difficult position. Mussolini supported Hitler, but Hitler's racial doctrines and naked aggression had been condemned by the Catholic Church. The Vatican's precarious position as a region of Rome meant that any false move might have had disastrous consequences. Pius used the few months before Mussolini entered the war to make his position clear. In October 1939 he issued his first encyclical (special address), *Summi Pontificatus*, praising the Poles and condemning Nazi Germany and Communist Russia, who had overrun Poland. Yet he was careful always to act with discretion. He never committed the Church to a policy favouring either side in the war, and refused to join an ideological 'crusade' against Nazism or Communism. The reason was that any measure such as excommunicating all who fought for the Nazis would have gravely embarrassed the millions of Catholics in Germany and Italy. Pius was too much of a realist to risk throwing the Catholic world in confusion.

After 10th June 1940, when Italy entered the war, the Vatican's communications were all but cut off. Nevertheless, the Vatican organisation for information concerning prisoners-of-war and missing soldiers did outstanding work. Moreover, after the Nazi occupation of Rome, many Jewish refugees found safety in the Vatican. The Pope's own peace proposals, which were elaborated in a speech to the College of Cardinals in December 1944, included appeals for the rights of small nations and minorities, economic co-operation, and disarmament.

After the war Pius introduced a number of important reforms in the Church. He authorised the administration of the sacraments in the vernacular (native language), as opposed to Latin, relaxed the rules of fasting before Holy Communion,

Pope Pius XII speaking at a war-time conference in the Vatican

and, above all, took the initiative in promoting the 'ecumenical movement'. His directive of 20th December 1949 prepared the way for an Ecumenical or General Council of the whole Church, which was ultimately to meet under Pius's successor.

But about 1949 a stiffening attitude can be detected in papal policies. The Iron Curtain had clamped down in Europe, and compromise with the Communists had proved impossible. In Communist countries the Church was being actively persecuted, and Pius launched a vigorous attack on Communist governments. In February 1949 he excommunicated all those concerned in bringing the Hungarian Primate, Cardinal

Mindszenty, to trial, and in 1951 he excommunicated all supporters of the Czech government's religious policy. He inaugurated special prayers for Russia, and in 1952 he addressed an Apostolic letter to the whole population of Russia – remarkable because it was not merely addressed to Catholics.

1950 was proclaimed a Holy Year, and, with thousands flocking to Rome, Pius took the opportunity of making several notable pronouncements. In his encyclical, *Summi Maeroris*, he condemned bacteriological and nuclear weapons as 'murderous and inhuman', and once more attacked the Communist regimes. In another encyclical, *Humani Generis*, he denounced those 'advanced' Catholics who sought to combine traditional Catholic doctrine with opposing philosophies, such as Communism. He called them 'lovers of novelty' who 'tried to reconcile opposing opinions in the field of dogma itself'. On 1st November he solemnly pronounced the dogma that the Virgin Mary was bodily assumed into Heaven.

Though constantly hampered by ill-health, Pius continued to play an active part in Church and world affairs until his death. In 1953 he urged all civilised nations to adopt a code of international law to punish war criminals, and told a mass congress of Italian teachers that there was a need for 'awakening an appreciation of political and economic realities in conformity with the Christian concept of life'. He attacked certain methods used by psychiatrists and warned them never to advise 'conscious action which does not lead towards divine perfection'.

Pius got through an incredible amount of work as Pope. He issued numerous encyclicals, messages, and letters, and was famous for the great number of private audiences he granted. When he died, on 9th October 1958, the mourners extended far beyond the confines of the Catholic Church.

A remarkable old man

When the College of Cardinals elected 77-year-old Angelo Roncalli as Pope, many people thought he was chosen as a 'stop-gap' – someone to hold the Papacy for a few years while the Church got used to being without the firm hand and guidance of Pius. Roncalli, or John XXIII as he became, was certainly a remarkable contrast to his predecessor. He was of peasant stock, and his robust appearance was very different from the pale, ascetic figure of Pope Pius.

Like Pius, John had been a Vatican diplomatist. In 1925 he was appointed Apostolic visitor to Bulgaria, where he established friendly relations with the Orthodox Church. In 1934 he was appointed Apostolic delegate to Turkey and Greece, and there is no doubt that his wide experience of eastern Europe gave him his life-long interest in the Orthodox Church and the problems of Christian unity. In 1944 he became Papal Nuncio in Paris, and in 1952 was appointed the first permanent observer of the Holy See to U N E S C O. The following year he was created a Cardinal and made Patriarch of Venice.

John soon showed he was not going to be a 'stop-gap' Pope. He had definite ideas of his own, and worked with the haste of an old man with a lot to accomplish.

His great achievement was, of course, to promote an atmosphere of friendliness and co-operation between the various Christian religions, and to win support all over the world for his ideal of Christian unity.

He set up, under Cardinal Bea, the Council of the Secretariat for promoting Christian unity, and gave an audience to the English Archbishop Fisher – the first Archbishop of Canterbury to visit the Pope since the Reformation.

John always stressed what Christians had in common rather than the things which divided them, and even extended his

Pope John XXIII enthroned at the first session of the General Council

friendship to non-Christians. He once said to the Mayor and Council of Venice: 'The only way to be a Christian is by doing good. Thus I am happy to be in this house, even though there may be some who do not call themselves Christian, but who can be acknowledged as such on account of their good deeds. To all I give my paternal blessing – to all without distinction.'

John's drive towards Christian unity was part of his desire to modernise the Church. This was obviously going to be a long task, far longer than the lifetime of one aged Pope. So, in 1962, John took a momentous decision and summoned a General Council of the whole Church. He wanted to bring before it contemporary problems, like the family, peace, poverty, underdeveloped nations, and religious persecution. He certainly wanted it to consider how a better understanding could be reached with other Christian communities, and invited representatives of the Orthodox Church to attend as observers.

Of course John's progressive ideas had opponents among the more conservative elements in the Curia, but John's successor, Paul VI, has said: 'Pope John has shown us some paths which it would be wise to follow. Death cannot stifle the spirit which he so enthused in our era. Can we turn away from paths so masterfully traced? It seems we cannot.'

John died in June 1963. Paul VI reconvened the General Council, and his spectacular pilgrimage to the Holy Land is thought to have been John's dying wish. Paul owes much to John, and indeed, whatever the Papacy may achieve over the next generation, it will remain deeply indebted to its two remarkable Popes, Pius XII and John XXIII.

THE BATTLE OF STALINGRAD

A lull in the fighting – women and old men emerge to cook a nasty meal in the ruins of the war-torn city

BY the summer of 1941 Hitler had behind him the most astonishing record of conquests in the history of warfare. He had conquered Poland in 27 days, Denmark in 1, Norway in 23, Holland in 5, Belgium in 18, France in 39, Yugoslavia in 12, Greece in 21, and Crete in 11. Hailed as 'the greatest military genius of all time', Hitler now prepared for his greatest conquest of all – the overthrow of Russia.

So, at dawn on 22nd June 1941 German divisions smashed their way across the Russian frontier and struck in three directions: Leningrad, Moscow, and the Ukraine.

The campaign was a spectacular, unprecedented success. German forces neared Leningrad, and reached the very outskirts of Moscow. And on 26th September the Germans took Kiev, the capital of the Ukraine. In all the Germans took no fewer than 1,500,000 prisoners, together with 7,000 tanks and 9,000 guns.

Yet the triple attack of the German armies was a grave mistake. Their resources were inadequate and their progress gradually lost its impetus. As the Russian winter approached, the German troops, completely unprepared for winter warfare, came to a halt. Vigorous counter-attacks began from Siberian reinforcements. So Hitler decided to 'dig in' and face what he had never wanted – a winter campaign.

The battle in the south

Hitler's position in the spring of 1942 was very different from the previous autumn. Contributing to his extraordinary success had been the reluctance of Soviet troops to support their government. As they marched through the Ukraine, German troops were garlanded and welcomed as liberators. But through a foolishness verging on insanity, Hitler failed to appreciate that his best allies could have been found within Russia. Instead, he wrote: 'Naturally the vast territories have to be pacified as soon as possible. This can best be achieved by shooting everyone who shows a wry face.' Soon he was attacked by countless acts of sabotage by 'partisans' in the rear of his lines. In addition, the United States had now entered the war, and Hitler had to prepare to meet fresh offensives in the West. Therefore, his policy became one of establishing a heavily defended frontier inside Russia, though, in the words of Goebbels: 'This might involve us in a 100 years war in the east.' For such a plan Hitler needed supplies, particularly oil. He therefore decided to occupy the vast Caucasus region with its rich oil reserves and extensive supply bases on the Black Sea. The key point in this occupation would be the capture of the city of Stalingrad (see map).

The southern campaign was code-named 'Operation Blau' (blue) and was to be carried out by two main army groups. Army Group A, consisting of the 17th Army and the 1st Panzer Army, was to conquer the Caucasus. Army Group B, consisting of the 6th Army under General von Paulus, the 4th Panzer Army under General Hoth, and the 2nd Army under General Weichs, was to occupy the Stalingrad area. Backing up these groups were Hungarian, Italian, and Romanian troops. Also in support was the 4th Romanian Army in the Crimea. The campaign opened in the Crimea on 8th May. On 15th May Kerch was taken, and on 2nd June Sevastopol was besieged. On 28th June the Stalingrad campaign proper was opened by a

dramatic advance by the 2nd Army and 4th Panzer Army from Kursk towards Voronezh. Then, on 30th June, the 6th Army advanced between Bielgorod and Volchansk and pressed towards Korotoyak on the Don. On 10th July the 4th Panzer wheeled towards Stalingrad and took Kantemirovka.

Meanwhile, on 9th July, Army Group A had moved north-east and taken Lisiachiansk. On 17th July the Russians abandoned Voroshilovgrad, and, on the same day, the 1st Panzer Army crossed the Donetz at Kamiensk. Also on that day Hitler sent the 4th Panzer Army down to help the 1st Panzer Army. This left the 6th Army to press alone towards Stalingrad.

The Russians in retreat

On 22nd July the key railway junction at Rostov was attacked by the 17th Army and the 1st Panzer Army (reinforced by the 4th). It collapsed. Meanwhile the 6th Army was steadily pushing westwards towards Stalingrad and on 24th reached the bank of the Don at Kremenskaya.

Thus, at the end of July, the situation was as follows: in the south the 17th Army and the 4th Romanian Army were moving in on Novorossisk and Tuapse; the 1st Panzer Army was advancing on the Maikop-Voroshilovsk line; the 4th Panzer Army had reached Proletarskaya on the railway line between Novorossisk and Stalingrad. But the 6th Army was halted immediately west of Kalach, due to shortages in ammunition and fuel.

Hitler now decided to make his all-out effort to take Stalingrad. The 4th Panzer Army was ordered to return north along the Novorossisk-Stalingrad railway, and on 23rd August it occupied Kotelnikovo. By this time the 6th Army had made a crossing on the Don, conquered Kalach, and set out on the final lap towards Stalingrad. On 23rd August it reached the outskirts of the city and closed the gap between the Volga and Don rivers. On 2nd September it made contact with the 4th Panzer Army at Kotelnikovo. On 12th September von Paulus received orders from Hitler to take Stalingrad by storm on 15th September.

The German assault began on 15th September, and on 26th the 6th Army broke into the factory district in the north sector of Stalingrad. A short pause followed, and then, on 4th October, the 6th Army edged forward. Street by street, house by house, the attack was ferociously pressed home. The inhabitants resisted furiously. Workers poured out of the factories to fight the Germans with their picks. After 10 days Hitler ordered the city to be destroyed by artillery, and so the battle continued through the ruins and rubble. The terrible fighting became known as the 'rat war'. Stalin clung to the city which bore his name, yet on 9th November Hitler announced: 'Not one square yard of land will be given up.'

By mid-November the general situation was this: the 6th Army was in Stalingrad; the 4th Panzer Army had been severely damaged and had withdrawn to Kotelnikovo; the 4th Romanian Army was holding the Ergeni Hills; and the 3rd Romanian Army stood west of Kletskaya. North of this came the Italian and Hungarian armies, which stretched to the region of Voronezh and contacted the 2nd German Army.

Despite their fantastic advances, time was not on the German side. The vast resources of Siberian man-power were being drafted by Marshal Zhukov, and by 2nd November German Intelligence had confirmed that the Russians were building bridges on the Don. This could only mean a counter-offensive. On 19th November it began. Its object was to break through both north and south of Stalingrad, and then converge on Kalach. The advance German armies would then be completely surrounded.

The Stalingrad campaign

Both the 3rd and 4th Romanian Armies were broken through on 19th and 20th November, and on 22nd November the Russian armies had linked at Kalach as planned. Von Paulus, in Stalingrad, was cut off. He could, no doubt, have broken through, but on 24th November Hitler ordered von Paulus to stand fast and renamed his army 'Fortress Stalingrad'.

Hitler's plan was to break through the new Russian line and re-establish the Stalingrad front. On 22nd November he sent von Manstein to command 'Army Group Don', which consisted of 'Fortress Stalingrad', the 4th Panzer Army, and the 3rd and 4th Romanian Armies. Von Manstein attacked on 12th December and by 21st December was within 30 miles of Stalingrad. He warned von Paulus to be prepared to break out within 24 hours, but von Paulus refused. He claimed he had only fuel to move for 20 miles, though, in fact, he was almost certainly waiting for direct orders from Hitler. Urgency was essential, for von Manstein's position was now precarious. The remnants of the 3rd Romanian Army, clinging along the Don and Chir, south from Veshenskaya, collapsed on 17th December. On 19th the Italian line was broken and von Manstein was threatened with encirclement. On 24th December he withdrew rapidly west.

With Hitler's consent, Army Group A evacuated the Caucasus and recrossed the Don on 22nd January 1943. The Germans' entire Don front had collapsed, and a 200-mile gap between Voroshilovgrad and Voronezh had appeared. In Stalingrad, with the temperature 28°F below zero, typhus and dysentery were killing thousands of Germans. In mid-January von Paulus reported to Hitler that his troops could not stand it. The reply read: 'Capitulation is impossible. The 6th Army will do its historic duty at Stalingrad until the last man.' On 25th January the last German airfield in the region was captured, and the 6th Army lost contact with the outside world. On 31st January von Paulus was made a Field-Marshal. The same day the army radioed back its last message: 'The Russians are before our bunker. We are destroying the station.'

Between that day, 31st January, and 2nd February, the entire 6th Army surrendered. Von Paulus, together with 23 generals, 2,000 officers, 90,000 other ranks, and 40,000 non-combatants, handed themselves over. Altogether, apart from fantastic losses in equipment, 100,000 men of the 6th Army had been killed. Perhaps they were the lucky ones, for the treatment of the prisoners was quite inhuman. According to reports, some 50,000 prisoners died of starvation in the first six weeks of their captivity. And from then until the end of the war the German cause declined as that of the Allies advanced.

BEETROOT

Entire plant of sugar beet

THE PLANT AND ITS VARIETIES

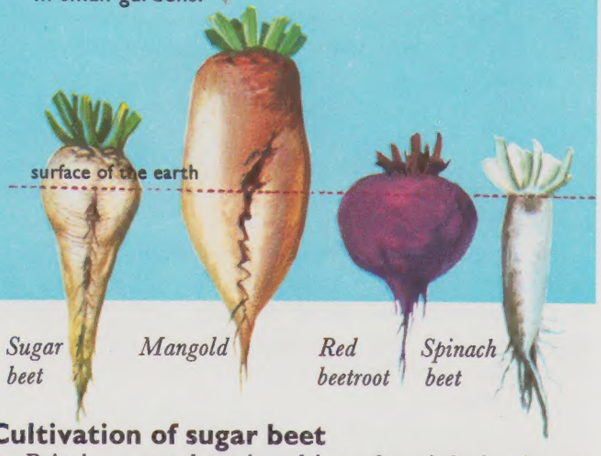
The beetroot (*Beta vulgaris*) belongs to the Family Chenopodiaceae. It was probably first cultivated in the Mediterranean region. There are four main varieties in cultivation, and a form called sea beet grows wild around the coasts of Britain.

Sugar beet. This plant has abundant foliage and is deep-rooted; the top of the root projects a very little above the ground. This is the variety that yields sugar.

Mangold. Also known as field beet or mangel-wurzel. When the root reaches full size about half of it is above the ground, and it may weigh 6 or 7 pounds. It is grown entirely as a source of winter food for cattle and sheep. The seed is sown towards the end of April; in autumn the roots are lifted and stored in straw-covered clamps to prevent frost damage.

Red beetroot. The familiar beetroot of the vegetable garden, distinguished by its deep-red colour. The variety shown here is the globe beetroot, but long-rooted forms are grown as well.

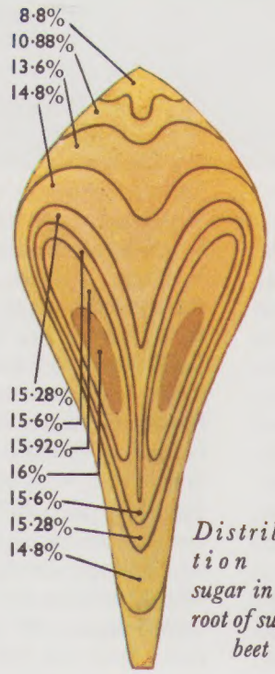
Spinach beet or **perpetual spinach.** This variety of beetroot is grown for the sake of its leaves, which are used as a substitute for spinach. It is very easy to grow, and leaves can be taken from the plants time after time. It is a most useful vegetable in small gardens.



YOU have almost certainly eaten a salad which contains deep-red slices of beetroot soaked in vinegar. A much less familiar beet, but one of far greater economic importance, is the sugar beet, as it is a rival of sugar cane (see page 2716) in the production of the 55 million tons of sugar consumed in the world every year.

The history of sugar production from beet began in 1747, when Andreas Marggraf, a German chemist, obtained a small quantity of sugar from this root. Very little progress was made, however, until the early years of the 19th century, when Napoleon I set out to break the monopoly of imported cane sugar from the tropics, which was held by the English, who had mastery of the seas. The French chemist Delessert devised a practical means of extracting the sugar, and it is said that Napoleon was so delighted when he received the first substantial sample of sugar that he took off his own cross of the Legion of Honour and pinned it to the inventor's coat. In 1813 there were 334 factories in Europe making beet sugar, and by the middle of the century sugar beet was well established as an economic crop.

In Britain the industry took a long time to become established – it hardly existed before 1912. Since 1933 British production of beet sugar has stood at around half a million tons yearly. The U S S R is now by far the biggest producer.

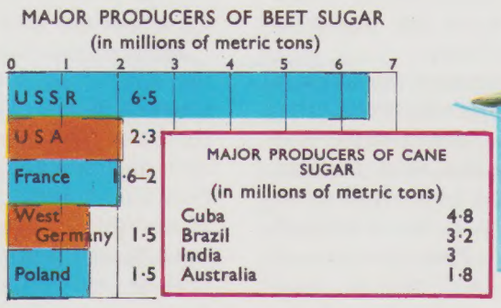


Distribution of sugar in the root of sugar beet

Cultivation of sugar beet

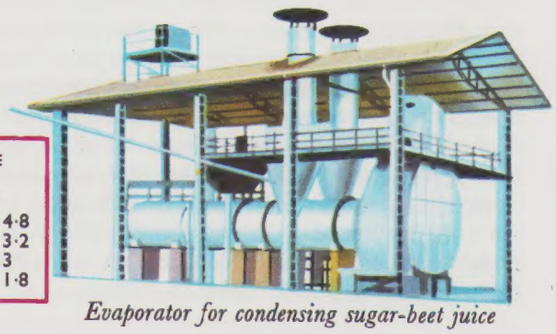
In Britain, sugar beet is cultivated mainly in the eastern part of the country, from southern England to Morayshire. A deep loam with good drainage is the best soil for the crop, and a moderate amount of fertiliser and manure is used; the sugar yield is improved if 5 hundredweight of salt per acre is also applied. The roots must be lifted before the plants run to seed; otherwise, they are useless.

Sowing time:	early April
Harvesting or lifting the roots:	October
Amount of seed per acre:	15 to 20 pounds
Yield of root per acre:	10 to 15 tons
Average weight of roots:	1 to 2 pounds
Yield of sugar per 100 pounds of roots:	15 to 20 pounds



MAJOR PRODUCERS OF CANE SUGAR
(in millions of metric tons)

Cuba	4·8
Brazil	3·2
India	3
Australia	1·8



Evaporator for condensing sugar-beet juice

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Some of the different kinds of drug which are used in the preparation of pharmaceutical products

Anaesthetic: A drug which renders a person insensible, and thus makes it possible for a surgeon to perform an operation without causing pain.

Analgesic: A drug which reduces pain. The expression is used both for drugs like aspirin, codeine, and morphia, which are given to relieve the pain associated with certain diseases and injuries, and for *local anaesthetics* such as are used to make dental extractions painless.

Antacid: Sodium bicarbonate, or merely 'bicarbonate', is the most familiar of the drugs which are used to relieve indigestion. They do so by neutralising excess hydrochloric acid in the stomach. Other antacids include milk of magnesia and aluminium hydroxide.

Anthelmintic: A drug to kill or paralyse parasitic worms in the intestine, and which thus facilitates their expulsion. At one time drugs of plant origin were largely used for this purpose. Today there are many safer and more effective laboratory-made compounds.

Antibiotic: Many moulds make substances which, when injected into animals, will kill dangerous microbes without harming the tissues of the host animal. Such substances are known as antibiotics. The first of these to be used in the treatment of human illness was penicillin. Many more are now available, of which streptomycin, chloromycetin, and aureomycin are well known.

Antiemetic: Sea sickness, train sickness, air sickness, and car sickness can often be relieved by means of antiemetic drugs. The alkaloid *hyoscine*, prepared from deadly nightshade, was at one time used widely for this purpose. There are now many laboratory-made compounds which have similar effects.

Aloe (Aloe socotrina) – *used in purgatives*

Antihistamine: The symptoms of hay-fever and of bites and stings are partly caused by histamine in the tissues. Antihistamine drugs neutralise this unpleasant substance, and reduce its ability to cause discomfort.

Antimalarial: Drugs which prevent malaria and drugs which cure it are called antimalarials. Quinine, a bitter-tasting preparation from the bark of the South American cinchona tree, was once the most important drug in this group. It was used chiefly in the *treatment* of malaria.

Since the Second World War its importance has diminished owing to the widespread use of laboratory-made drugs which *suppress* the disease.

Antipyretic: A drug used to reduce a patient's temperature. Aspirin has this effect.

Hyperimmune serum: Sera prepared in horses are used for protecting people from certain infectious diseases to which they have been exposed. These sera have to be given within a relatively short time after exposure, and this is why they are occasionally rushed across the world by air, or across a country by police car. A widespread use of one such serum is to prevent lock-jaw after street injuries. Serum is also used for protection from diphtheria and the effects of snake bite.

Hypotensive: High blood pressure is one of the most common of human ailments, and drugs of this type are used to reduce the pressure to safer levels. Some hypotensive drugs are obtained from plants, others are made by chemists.

Purgative: A drug intended to increase the activity of the bowels. Such drugs are sometimes called laxatives or aperients. Aloes, rhubarb, cascara, castor oil, phenolphthalein, and Epsom salts are used for this purpose.

Cinchona peruviana – *used in treatment of malaria*

Soporific: A drug used to induce sleep. Sleeplessness is such a common inconvenience that sleep-producing drugs are used in vast quantities. Barbiturates (drugs based on barbituric acid) are chiefly used, though very many other drugs have similar effects. Among them is morphia, which is named after Morpheus, the god of sleep.

Sulphonamide: Drugs based on the compound para-aminobenzene-sulphonamide are known as sulphonamides. They are effective in infections caused by certain bacteria, though their importance has been reduced by the discovery of the antibiotics.

Sympathominetic: Drugs which produce effects on the body similar to those produced by stimulation of the sympathetic nervous system. Hyoscyamus, obtained from the plant henbane, has some of these effects. It relaxes the muscle of the intestinal wall, and in consequence is often incorporated in purgative medicines.

Tonic: A medicine intended to make a person feel more alert and active. Most tonics contain a bitter substance such as gentian, which, if taken before meals, improves the appetite. The effects of many tonics probably depend on this.

Tranquilliser: A drug used to allay worry. Very large quantities of drugs of this type have been used to soothe the troubled minds of business-men and the mental torments of anxious women. It is probably unwise to take this type of preparation without medical supervision.

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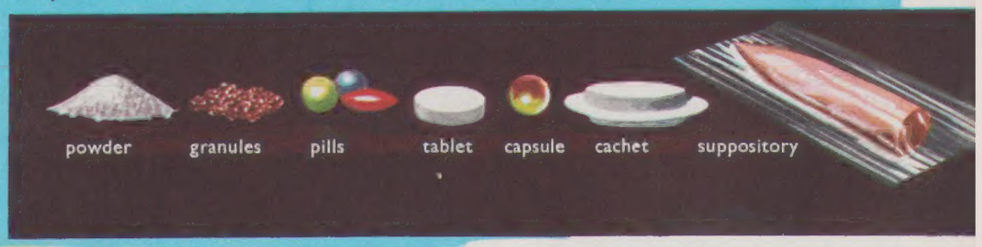
TAKING MEDICINE

Here are examples of the many ways in which solid pharmaceutical preparations are presented for administration to a patient:



Mixtures and syrups are dispensed in bottles

Pastes and ointments: used chiefly in treating skin disorders

In illnesses in which a patient is unable to drink, his body soon becomes short of water. The necessary fluid is provided by running a dilute solution of salt from an apparatus such as the one shown below into a vein in the patient's arm.

Poultice – used to bring a boil to a head

Injections: medicines intended for administration by injection are usually presented in single-dose ampoules. The contents are drawn into a syringe and then injected

In bronchitis and asthma it is often possible to make breathing easier by inhalations of the vapour of certain medicaments. Friar's balsam is most often used. It is mixed in a bowl or jug with boiling water, and the patient surrounds his head and the bowl in a towel, and breathes in the fumes.